GNHWPCA

Greater New Haven Water Pollution Control Authority

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Wastewater Treatment System

Performance Evaluation Report

December 2011

Report Prepared By:

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Executive Summary

In February 2011, The Greater New Haven Water Pollution Control Authority (GNHWPCA) requested Malcolm Pirnie (Pirnie), the water division of ARCADIS, to assist with contract monitoring of the Service Agreement (Agreement) between the GNHWPCA and the contract operator Operations Management International, Inc. (OMI) dated November 21, 1997. This Wastewater System Performance Evaluation Report (Report) was prepared for the GNHWPCA pursuant to the Agreement for Professional Services between GNHWPCA and Pirnie, Task Assignment Letter Number 1, for Contract Operations Monitoring Services, dated February 24, 2011.

Project activities were performed in the second quarter of 2011 and included the review and inspection of OMI's project management, operations, and maintenance activities for the GNHWPCA's East Shore Water Pollution Abatement Facility (WPAF) and pump stations. This Report presents a summary of the observations, recommendations, and risk ratings resulting from our field inspections and the review of operating data relative to OMI's compliance with the Agreement and overall regulatory standards.

- **System Condition and Maintenance.** This section of the Report provides a general assessment of the condition of major process components and the appropriateness of the operational and maintenance practices at the WPAF and pump stations according to the Agreement and acceptable industry practices. Pirnie used a risk rating system (1 high risk; 2 significant risk; 3 some risk; 4 little to no risk) for major process components and the pump stations to provide GNHWPCA and OMI a means to prioritize future operations and maintenance efforts. The risk rating system criteria is defined in Table 2-3 at the end of Section 2.
- **System Management and Performance.** This section of the Report evaluates OMI's management of the GNHWPCA's wastewater pump stations and treatment system (System) through its environmental compliance and adherence to other performance criteria set forth in the Agreement. Data was provided for a 2 year period, from April 2009 – 2011.

Key observations from each of these sections are summarized below and described in greater detail in the body of the Report.

System Condition and Maintenance

Treatment Plant Condition Inspections: OMI's WPAF process risk ratings were high (2, significant risk) for the Grit and Screenings, Primary Clarifiers, and Solids Handling processes due to equipment being out of service and in poor condition. In

each of these process areas, critical process equipment was inoperable beyond acceptable industry practice.

Most of the remaining process systems including the Main Sewage Pumps, Activated Sludge, Secondary Clarifiers, Disinfection, and Odor Control, received process risk ratings of 4 (some to little/no risk). These areas generally had reliable equipment with sufficient redundancy. Several of these systems were rehabilitated or replaced within the last 10 years (i.e., Main Sewage Pumps, Aeration Blowers, and the Disinfection chemical system). These systems are in very good operating condition and require only some preventive measures to maintain long-term operability of the systems.

Throughout the WPAF, many system components, although reported reliable, appeared to be nearing the end of their useful lives. These items should be considered for replacement in the near future.

- **Pump Stations Condition Inspections:** GNHWPCA owns 30 pump stations throughout the Greater New Haven region. The 4 largest pump stations reside in New Haven with design capacities ranging from 10,000 to 30,000 gallons per minute (gpm). In general, these large pump stations were in fair operating condition. Two of the stations, Boulevard and East Street, received a risk rating of 2 (significant risk) due to some out of service equipment or equipment in poor or inoperable condition, specifically in the inlet works areas. Morris Cove, a new pump station, and State and Union both received risk ratings of 3 (some risk).

  GNHWPCA owns 6 medium-sized pump stations with design capacities ranging from 1,200 to 5,000 gpm. In general, the medium stations were in good operating condition and require only some preventive measures to maintain long-term operability of the stations. All of the medium pump stations were scheduled for or had received station-wide renovations. The average risk rating for the 6 stations was 3.7 (some to little/no risk).

  GNHWPCA's remaining 20 stations are small stations with design capacities ranging from 90 to 875 gpm. In general, the small pump stations were in good operating condition. Several were scheduled for or had received station-wide renovations. Some had older pumps and generators; however, most were reported or observed to be operable. The average risk rating for the 20 stations was 3.2 (some risk).

  Most of the pump stations received recent telemetry upgrades a part of an overall system-wide SCADA implementation. The improvements allow OMI staff to remotely monitor the stations and receive notification of pump failures or other alarm conditions as they occur.

- **Truman Wet Weather Storage Tank Facility:** This newly constructed facility was in good operating condition with a well–maintained appearance. OMI has received a

small number of odor complaints from the local community; otherwise there are no reported issues. The facility received a risk rating of 4 (little to no risk)

- **James Street Siphon:** The James Street Siphon is a 3-barrel sanitary sewer siphon that carries flows across the Quinnipiac River from New Haven to the WPAF. The siphon facility received a risk rating of 2 (significant risk) due to out of service equipment and poor equipment condition with reported chronic failures.
- **Maintenance Management System:** In 2009, GNHWPCA purchased a new "out-of-the-box" web-based solution called Maintenance Connection to replace its existing computerized maintenance management system (CMMS) called Datastream MP2. During our review we focused on the availability and completeness of CMMS data for equipment identified on GNHWPCA's Critical Equipment List, and we identified several specific activities that must be completed to move forward with the system implementation and address GNHWPCA's critical equipment data needs. The overall capabilities of the system appear promising but progress has been slow. GNHWPCA and OMI are currently negotiating to hire a Maintenance Clerk to assist with data entry and upkeep for the CMMS.
- **Large Diameter Sewer Cleaning**: Approximately 40 miles of the GNHWPCA collection system is large interceptor piping sized between 36 inches and 72 inches in diameter. These interceptors tend to collect significant amounts of grit and heavy debris and should be inspected and cleaned as required to maintain uninterrupted flow capacity and minimize CSO discharge events. In 2004, OMI agreed to evaluate the requirements for establishing a cleaning program and look into effective cleaning methods for these interceptors. OMI submitted a plan to the GNHWPCA, but it is our understanding that to date, the large diameter sewers have not been cleaned.

System Management and Performance

- **Environmental and Nitrogen Compliance:** During this evaluation period OMI performed well with respect to its National Pollutant Discharge Elimination System (NPDES) permit and performance criteria established in the Agreement for biochemical oxygen demand (BOD), suspended solids (TSS), fecal coliform, and chlorine residual. OMI also performed well with respect to total nitrogen (TN) requirements under the State's General Permit.
- **Odor Complaints:** OMI received only 2 WPAF-related odor complaints during this evaluation period. The complaints were received on 2 consecutive days and produced by the same single source. Two non-WPAF related complaints were also received during the evaluation period.
- **Electrical Power Consumption:** Electrical consumption was evaluated for the 2009 and 2010 calendar years using values provided by Electricity Excess Usage Invoices

issued to OMI by GNHWPCA. OMI exceeded the Maximum Annual Usage per Schedule 9 (adjusted for nitrification inhibition) of the Agreement both years.

- **Chemical Consumption:** Pirnie evaluated consumption of chemicals used in the disinfection process (sodium hypochlorite) and the odor control systems (sodium hypochlorite and sodium hydroxide). The monthly consumption of sodium hypochlorite in 2010 was generally greater than consumption in 2009. Seasonal increases reflect increased consumption by the odor control systems during the late summer and early fall months. Conversely, sodium hydroxide monthly consumption decreased in 2010 compared to the previous year. The change in consumption of both chemicals in 2010 is attributed to OMI's greater reliance on sodium hypochlorite rather than sodium hydroxide for wet scrubber odor control systems. OMI has found it cost effective to use more sodium hypochlorite to reduce the amount of sodium hydroxide required.

- **Sludge Production:** Sludge production was evaluated for the period of April 2009 – April 2011. OMI's sludge production was well below the GNHWPCA's monthly sludge allowance with Synagro most months in that time period. OMI exceeded the sludge allowance once in May 2009.

Conclusion

Overall, we concluded that the WPAF performed well over the 2 year evaluation period regarding environmental and nitrogen compliance. Several of WPAF systems and pump stations have been rehabilitated or replaced within the last 10 years and are in good operating condition. In addition, recent system-wide SCADA upgrades have improved remote communications and allow OMI staff to remotely monitor the pumps stations and receive alarm notifications. With regards to proper maintenance of GNHWPCA's assets, OMI has fallen short of its Agreement obligations. OMI must improve its preventive and corrective maintenance practices and general housekeeping, particularly in the WPAF process areas and pump stations that received high risk ratings due to an unacceptable number of equipment that out of service or in poor condition. In support of improving its maintenance practices, OMI should take more responsibility for overseeing the CMMS implementation and completing data entry into the system.

1. Introduction

In February 2011, The Greater New Haven Water Pollution Control Authority (GNHWPCA) requested Malcolm Pirnie (Pirnie), the water division of ARCADIS, to assist with contract monitoring of the Service Agreement (Agreement) between the GNHWPCA and the contract operator Operations Management International, Inc. (OMI) dated November 21, 1997. Activities included the review and inspection of OMI's project management, operations, and maintenance activities for the East Shore Water Pollution Abatement Facility (WPAF) and pump stations. Pirnie evaluated OMI's compliance with the terms and conditions of the operations and maintenance contract for the purpose of long-term preservation of the GNHWPCA's wastewater treatment assets and continuous improvement of the GNHWPCA's arrangement with OMI. Note that we did not inspect the collection system buried infrastructure or data pertaining to the collection system. Contract year 2011 represents OMI's thirteenth contract year of providing services for the GNHWPCA wastewater system. The agreement has a term of 15 years and is scheduled to expire on November 21, 2012.

Pirnie performed its review and inspection of the GNHWPCA's wastewater treatment facility and pump stations in the second quarter of 2011. This Wastewater Treatment System Performance Evaluation Report (Report) presents a summary of the observations, recommendations, and risk ratings resulting from our field inspections, and the review of operating data relative to OMI's compliance with the Agreement and overall regulatory standards.

Inspection Dates

Pirnie representatives conducted field inspections as follows:

- East Shore WPAF Review: May 19 and May 20, 2011 by Seth Schneider and Crystal Knaak
- Pump Stations Review: May 4 and May 5, 2011, by Eric Muir and Daniel Dietrich
- Computerized Maintenance Management System (CMMS) Review: June 22 and July 8, 2011 by Lailani Metzler

GNHWPCA representative Charlie Biggs accompanied Pirnie through the WPAF and large pump stations. OMI representative Kevin Maltese accompanied Pirnie through the medium and small pump stations. Charlie Biggs and OMI representative Matt Crowley met with Lailani Metzler for the CMMS review.

Report Organization

This Report is organized according to OMI's major responsibilities as contract operator of the GNHWPCA wastewater pump stations and treatment system (System): System Condition and Maintenance and System Management and Performance.

2. System Condition and Maintenance

In accordance with the Agreement, OMI is responsible for the operation and maintenance of the GNHWPCA's System. The Agreement states that OMI shall:

"...perform all corrective, predictive, preventive and ongoing maintenance of the System such that the grounds, facilities, and facility structures shall be maintained at a level adequate for the efficient, long-term reliability and preservation of the capital investment, including maintaining the buildings, grounds and landscaping in an aesthetically attractive and clean condition"

"...perform all predictive, preventive and corrective maintenance relative to the System and Equipment in accordance with applicable federal, State and local laws, regulations and permits and generally accepted or recommended industry maintenance practices, procedures and standards for municipal wastewater treatment..."

This section of the report summarizes the condition of major process components and the appropriateness of the operational and maintenance practices at the WPAF and pump stations.

Pirnie used a risk rating system for major process components and the pump stations as part of the inspection results, to provide both the GNHWPCA and OMI with information to help prioritize operations and maintenance efforts. For our May 2011 inspection, we used the risk rating system summarized in Table 2-3 at the end of this section of the Report. The WPAF was evaluated according to each of the 8 main processes, allocating a risk rating to each process along with a brief explanation. The findings from the WPAF inspection are summarized in Table 2-4. Tables 2-5, 2-6, and 2-7, summarize pump station results, also assigning a risk rating to each with the supporting explanation.

In support of the condition and maintenance discussion, an overview of OMI's use of the CMMS to support maintenance activities for the System is also included.

2.1. Treatment Plant Condition Inspection

Major process component condition and maintenance observations for the WPAF are summarized in this section of the Report. The information in this section is presented by WPAF process area. Our observations, recommendations, and assigned risk ratings for the WPAF processes are based on our field inspections and discussions with GNHWPCA staff.

2.1.1. Grit and Screening

The WPAF headworks consist of three influent channels with isolation gates. Two of the channels are equipped with automated bar screens, while the third, "bypass" channel has a manual bar rack and is intended for emergency use. Under normal flow conditions, one automated bar screen channel is in operation. After screening, the flow enters the aerated grit tanks (4 total) for degritting. From each grit tank, flow is directed by a dedicated grit collector to one of two grit classifiers where grit is separated from the wastewater. The removed grit and screenings are then directed to a series of belt conveyors that discharge the combined material to a roll-off container for disposal.

Although the bar screens were operable during our visit, we observed them to be in poor condition. The screen backer plates and chains are severely corroded, and GNHWPCA reported that these bar screens experience frequent downtime. Additionally, the actuator for the bypass channel upstream isolation gate was not in place, and one automated bar screen channel downstream gate was inoperable. Consequently, only one automated bar screen influent channel was operable. While only one automated bar screen channel is required under normal conditions, if this channel were to become inoperable, operations would be severely compromised as staff would have to manually remove screenings from the bypass channel bar rack. Finally, GNHWPCA reported that the influent gates do not seal well, and sand bags were being used to stop flow into the channels that were not in service.

The screenings area was generally messy and ventilation was poor. We observed a large amount of standing water on the floor with no sump and no apparent means of eliminating the water. Ventilation ducts were badly corroded and no air monitoring sensors were in service during our visit. The area near the grit tanks was generally cleaner and ventilation appeared better. The grit collector/classifier and bar screenings conveyance area was generally messy with a lot of debris and old parts lying around. The headworks electrical area appeared clean and in good condition, with no major issues.

Of the four grit tank/grit collector combinations, only one was operable and in service during our visit. This lack of redundancy presents a serious risk to the grit removal process and grit removal is likely comprised during periods of peak flow with only one tank in service. GNHWPCA reported that the grit collectors are generally unreliable and experience frequent downtime. In general, the grit tank aeration piping and downstream gates appeared to be in good condition. However, the grit channel aeration blowers appeared to be in poor condition. Both grit classifiers appeared to be in fair condition and were reported to be operable during our site visit. The belt conveyors that are used to transport grit and screenings appeared to be in good condition, and the safety guards around the belt conveyors appeared relatively new.

We understand that OMI was in the process of repairing the two out of service downstream gates during our site visit, although we observed no active work at that time. GNHWPCA reported that air monitoring sensors for the headworks area had been procured but not yet installed. We also understand that OMI was in the process of overhauling all four grit tanks (grit collectors). The parts had been procured for all four tanks, but as of the time of our inspection, repairs were only completed on Grit Collector No. 4.

Recommendations

The headworks are to be upgraded in the first phase of the upcoming plant upgrade project; however, this project has been on-hold for quite some time and the design has yet to commence. Thus, it will likely be a number of years until this area is upgraded and the equipment replaced. Because of the high risks presented by out of service equipment in this area, we recommend expediting upgrades to the three remaining grit collectors and considering "interim" upgrades to the influent gates and bar screens.

Risk Rating

Based on our observations of out of service equipment and lack of redundancy, the grit and screenings process received a rating of 2 (significant risk). If/when scheduled repairs are made to the influent gates and grit collectors, the rating may improve to a 3 (some risk).

2.1.2. Main Sewage Pumps

The majority of influent flow to the WPAF is received at the main influent wetwell and pumped by the Main Sewage Pump system. The pump system includes five vertical non-clog main sewage pumps, (two larger pumps, Pumps Nos. 2 and 4, rated 25 mgd each; and three smaller pumps, Pumps Nos. 1, 3 and 5 rated 17.5 mgd each). The two large pumps are normally required to handle peak flows.

During our visit, Main Sewage Pump Nos. 1 and 2 were out of service due to problems with the pump variable frequency drives (VFDs). GNHWPCA reported that both pumps had only recently gone out of service, and that all five pumps were operable previously.

While the pumps are original from the mid-1970s, the pumps were re-built and equipped with new shafts, motors and VFDs in 2003. Three pumps (the three smaller pumps, 1, 3 and 5) were fitted with new impellers as well. In general, the main sewage pumps appeared to be in good condition, and downtime for these pumps has not recently been a problem. The wetwell level sensing system was in good condition and there are typically no problems operating the pumps based on wetwell level. Some of the main sewage pump discharge piping appeared highly corroded, while other pipe appeared to be

relatively new, or at least newly painted. We understand that OMI completed a main sewage pump discharge piping integrity evaluation a number of years ago, and we suggest OMI reevaluate the piping that appears highly corroded.

The main sewage pump wetwell covers appear old and corroded, and consideration should be given to future replacement.

The compressors located in this area appeared old and in need of upgrades in the near future. However, GNHWPCA reported that they operate acceptably. The boilers and hot water heaters in this area were replaced in 2002-2003 and are in good condition with the exception of some leaking condensate piping. Finally, we observed the instrument area compressor vibrating excessively.

The main sewage pump area appeared generally in need of upgrade. Acoustical tiles were falling off the walls and were in poor condition. In addition, the railings, pump equipment pads, and concrete in this area were showing signs of wear. The floor has a buildup of ash from the incinerator, giving the area a dirty appearance. The sump pumps in this area appear to be in fair condition and generally function as intended. In general, the main sewage pump area should be cleaned up, patched and re-painted.

Recommendations

The following are recommendations for the main sewage pump system based on our site visit observations:

- Test the main sewage pump discharge piping that appeared highly corroded to confirm its integrity.
- Clean, patch and re-paint the main sewage pump area to help preserve the area and improve its appearance.
- Focus on maintaining the operability and reliability of the recently rehabilitated units and keeping unit downtime to a minimum.
- Repair the VFDs on Pump Nos. 1 and 2 as quickly as possible to maintain the high degree of availability that is typical for this system.

Risk Rating

In general, the main sewage pumps are generally reliable and the process in good condition. Although two of the five main sewage pumps were out of service during our visit, based on the reported reliable operation of the pumps and their adequate redundancy, the main sewage pumps received a risk rating of 3 (some risk). If/when repairs are made to the VFDs for Pump Nos. 1 and 2, the rating may improve to a 4 (little to no risk).

2.1.3. Primary Clarifiers

After the headworks, flow is directed to three rectangular primary clarifiers. Each clarifier is equipped with a chain and flight collector mechanism for removing skimmings (scum, floatables, grease) and settled sludge. Each clarifier has an associated skimmings (scum) well, where skimmings are collected and pumped with chopper-type pumps to an incinerator. At least two clarifiers are needed hydraulically under normal conditions. Under peak flow conditions, all three clarifiers should be in operation. In terms of solids settling capacity, at least two clarifiers should be fully functional. For limited periods of time and during low flow conditions, it may be acceptable to have only one clarifier in service, but it is certainly not desirable.

Of the three primary clarifiers, only Primary Clarifier No. 1 was in service during our visit. The deflector rails on Primary Clarifier No. 2 were broken, and this tank was being dewatered for repairs during our visit. We understand that the broken rails are to be replaced with new stainless steel rails. In addition, Primary Clarifier No. 3 has been out of service for an extended period of time. This tank is undergoing a complete rehabilitation and all internal components (chain and flight collectors) are to be replaced. GNHWPCA reported that the rehabilitation parts had been procured, but we observed no active work during our site visit, nor did it appear that significant progress had been made on this tank. Primary Clarifier No. 3 was being used in "flow through" mode, with the clarifier accepting approximately half of the primary influent flow. However, no solids or skimmings were being removed from this tank, as no internals exist.

Further, we understand that skimmings collection has not functioned in any of the primary clarifiers for a long period of time because the skimmings tubes are out of service. Consequently, floatables pass through the treatment process for removal in the secondary clarifiers. When they were in service, GNHWPCA reported the chopper pumps and mixer for the skimmings pits worked well. The permanent gas detectors mounted on the clarifiers are not functional and portable detectors are used instead for clarifier entry. Chain and flight collector drive motors for all three primary clarifiers appeared to be in good condition.

In general, the primary clarifier tanks themselves appeared to be in good condition structurally, and no major issues were observed.

Recommendations

Downtime with the primary clarifiers has been an on-going issue for many years, and continues to be a problem now. The out of service equipment in this area presents a high risk, and we recommend expediting the upgrades to Primary Clarifiers No. 1 and 2. While Primary Clarifier No. 2 has only recently been out of service for repairs, Primary Clarifier No. 3 has been out of service for at least two years (maintenance data was only

requested for the last two years). This extensive downtime is unacceptable and is not in accordance with standard industry practice. And, as mentioned previously, having less than all three primary clarifiers in service increases the risk of problems during high flow conditions because solids removal is compromised.

Risk Rating

Based on our observations of out of service equipment and lack of redundancy, coupled with the criticality of this process, the primary clarifiers received a risk rating of 2 (significant risk). If/when scheduled repairs are made to the primary clarifiers, the rating may improve to a 4 (little or no risk).

2.1.4. Activated Sludge Process

The WPAF has four activated sludge aeration tanks that operate based on the modified Ludzak Ettinger process for biological nutrient removal (BNR). The tanks are arranged in parallel, with two tanks on each side (North and South) of a central walkway. The process consists of an anoxic zone at the head of each tank where incoming primary effluent combines with return activated sludge (RAS) and recycled mixed liquor. Submersible mixers installed in the anoxic zone keep the mixed liquor in suspension and prevent solids from settling. There are a total of 10 anoxic zone mixers and eight mixed liquor recycle pumps (referred to as NRCY pumps). The mixed liquor flows from the anoxic zone to the aerobic zone, where it is aerated to induce nitrification. Process air is provided by five aeration blowers. Blower Nos. 1, 4 and 5 are large 700 hp blowers, whereas No. 2 and No. 3 are smaller 400 hp blowers.

For optimal treatment, all four aeration tanks should be in service. During normal conditions, three aeration tanks are adequate to treat all of the flow if one tank is down for maintenance. However, tanks are normally only taken out of service in the winter when flows tend to be lower, unless emergency conditions necessitate otherwise. In addition, one large blower and one small blower are adequate to meet aeration requirements under average flow conditions. Under peak conditions, two large blowers, or two small plus one large blower are required. When all eight mixed liquor recycle (NRCY) pumps are in service, approximately 400% of aeration tank influent flow can be recycled (i.e, the NRCY pumps can convey four times the aeration tank influent flow). Normally, all eight NRCY pumps should be in service.

During our site visit, all four aeration tanks were in service. In general, all flow isolation/ flow splitting gates appeared to be in good condition, including the main primary effluent gates that split flow to each aeration tank and their actuators. There are two main gates provided to isolate RAS flow to the aeration tanks. One gate isolates one side (two aeration tanks), and the second gate isolates flow to the other two aeration tanks. These RAS gates were previously automated. One gate actuator has already been replaced with

a manual handwheel, and OMI is in the process of replacing the other actuator. Most of the RAS gates to each aeration tank appear to be in good condition, and those that were closed at the time of our visit appear to be sealing tightly. However, some of the gate handwheel operators were held on with clamps, and should be repaired. Of the ten anoxic zone mixers, nine are currently in service. GHWPCA reported that OMI plans to repair the out of service mixer this winter when other aeration tank maintenance is normally done. With this mixer out of service, it is possible that there is a zone of solids settling due to poor mixing in this one aeration tank. While the mixers generally appeared to be in good condition, they were originally installed in 1995 and are nearing the end of their useful lives. OMI should consider replacing these mixers in the next few years. All dissolved oxygen (DO) and oxidation reduction potential (ORP) probes appear relatively new and in good working order.

During our site visit, we observed three significant air diffuser "blow-outs". These blow-outs created large areas of uncontrolled oxygen flow, which were likely starving nearby areas of adequate oxygen. GNHWPCA reported that couplings on the diffuser piping frequently come loose, causing these blow-outs. Although repair of these blow-outs requires OMI to isolate and drain an entire tank, these blow-outs are compromising process efficiency and effectiveness and need to be corrected immediately.

The main air piping headers are located outside and are exposed to the elements. Much of this piping is in need of re-painting and is in danger of serious degradation if not painted in the near-term. In addition, due to the significant external corrosion, we recommend that OMI evaluate the pipe to verify that the corrosion damage is only external and has not significantly affected the integrity of the piping. We observed a number of audible leaks in the air piping that appeared to be originating from joints. These leaks waste energy and should be repaired. In addition, the silencers near each blower were rusted and should be re-painted. OMI recently replaced the individual drop leg actuators for the entire system, and the new actuators were reported to be functioning well and reducing fluctuations in actuator settings and dissolved oxygen (DO) concentrations.

Of the five aeration blowers, four were in service during our site visit. Blower No.5 is the last fully original blower/motor combination from the 1995 upgrade. This blower has been out of service due to motor issues for many months. The two smaller blowers and their associated motors were completely replaced recently, and the motors for the two other large blowers have been replaced in recent years. OMI should also consider replacing the motor for Blower No. 5. With the exception of Blower No. 5, the blowers appeared to be in good condition and appear to be well-maintained given that they are located outdoors and are exposed to the elements. Blower No. 1 is in need of re-painting.

During our site visit, none of the NRCY pumps were operational. It is our understanding that only two of the eight NRCY pumps were out of service. However, the pumps are arranged with four pumps serving each pair of aeration tanks (on the North and South sides). To perform maintenance on any one pump, we were told that all four pumps on that side must be taken out of service. During the site visit, OMI was preparing to move one operable pump from one side to the other, and thus both sides were isolated and removed from service. The NRCY pumps are critical to the BNR process and the downtime on these pumps should be minimized.

The aeration tank concrete that is visible above the water surface generally appeared to be in good condition. According to GNHWPCA staff, concrete below the water surface was observed to also be in good condition. However, based on an inspection of the outside of the tanks, a number of expansion joints were in poor condition, and expansion joint repairs should be undertaken. Repairs have already been made on a number of these joints. Because tanks were not dewatered to perform an interior inspection of the tanks, the interior condition of the expansion joints could not be ascertained. However, OMI should consider dewatering and inspecting the interior of each aeration tank within the next few years. Additionally, the wall between the aeration tanks and the secondary clarifiers was showing signs of rusting reinforcing bars coming through the surface of the concrete. This damage was exacerbated by a sodium hypochlorite spill in this vicinity.

We also observed a fairly large amount of accumulated trash and debris in the aeration tank effluent launders. These launders should be cleaned to prevent these solids from carrying-over into downstream processes.

The secondary system is equipped with a bypass channel to divert flow around the secondary system directly to the chlorine contact tanks during high flow periods. The channel is equipped with two automated gates so that flow can be diverted automatically when necessary. The actuator on one of these gates was recently replaced and the other is original to the 1990s upgrade, although it appeared to be in satisfactory condition. A Parshall Flume, equipped with an ultrasonic level sensor, is used to measure the bypass flow. The ultrasonic level sensor was recently replaced and appeared to be in good condition.

Recommendations

The following are recommendations for the activated sludge process based on our site visit observations:

- Repair all gate handwheel operators.
- Accelerate repairs to the anoxic zone mixer that is out of service to minimize dead zones and solids deposition.

- Consider replacing all anoxic zone mixers within the next few years, as these mixers are nearing the end of their useful lives.
- Repair air piping blow-outs within the aeration tanks immediately.
- Re-paint exterior process air piping and appurtenances and evaluate that piping for long-term integrity.
- Repair leaks in exterior exposed process air piping.
- Consider replacing the motor for Blower No. 5.
- Re-paint Blower No. 1.
- Repair the two NRCY pumps that were out of service and minimize downtime within this system.
- Repair aeration tank expansion joints from the exterior of the tanks, and plan for interior tank inspections.
- Clean aeration tank effluent launders of accumulated debris.

Risk Rating

In general, the activated sludge process at the WPAF appeared to be in good condition and equipment downtime is within reasonable ranges of accepted practice. Based on our observations, the reasonable amount of out of service equipment, and adequate redundancy, the activated sludge process received a risk rating of 3 (some risk).

2.1.5. Secondary Clarifiers

From the aeration tanks, mixed liquor is conveyed to eight circular final (secondary) clarifiers for solids settling and skimmings removal. The secondary clarifiers are arranged with four tanks on each side (North and South) of a central walkway. The secondary clarifiers are equipped with scraper mechanisms and rapid sludge withdrawal tubes for RAS withdrawal and a center hopper for waste activated sludge (WAS) removal. A skimmings arm directs the skimmings to a beach, where it is conveyed to skimmings (scum) wells. There are four scum wells, each equipped with a submersible, non-clog scum pump that pumps the skimmings to either a frac tank or a holding tank prior to incineration. In general, all eight secondary clarifiers are intended to be in service, with the exception of when a tank needs to be drained for maintenance.

Return activated sludge (RAS) from the secondary clarifiers is pumped back to the aeration tanks by the RAS pumps. The ten RAS pumps are divided between the north side and the south side, with each area containing five pumps (one pump for each of four secondary clarifiers on that side, and one swing pump). Waste activated sludge (WAS) from the secondary clarifiers is pumped by the ten WAS pumps to the gravity belt thickeners. The WAS pumps are also divided between the north side and the south side,

with each area containing five pumps (one pump for each of four secondary clarifiers on that side, and one swing pump).

Actuators on the influent gates to Secondary Clarifier Nos. 3, 7, and 8 were recently replaced. Other gate actuators appeared to be reaching the end of their useful lives, although we understand that they function well. The scraper mechanisms also appeared to be nearing the end of their useful lives. Drive motors for each of these mechanisms were last replaced in 1994. The scraper mechanism drives reportedly function well and are quite reliable.

Non-submerged portions of the secondary clarifiers appeared to be in good condition structurally. According to GNHWPCA staff, submerged portions are also generally in good condition. However, visual inspection of the outside of the tanks revealed a number of expansion joints in poor condition, and expansion joint repairs should be undertaken. Repairs have already been made on a number of these joints. The interior condition of the expansion joints could not be ascertained during our inspection, and we recommend dewatering and inspecting the interior of each aeration tank within the next few years. A number of walkway areas around the secondary clarifiers exhibited significant concrete deterioration, and the walkway railings were rusted and in need of painting. These areas should be repaired to prevent further damage and to minimize health and safety issues related to trips and falls.

During our site visit, all eight secondary clarifiers were in service and functioning as intended. We understand that downtime on the secondary clarifiers is minimal.

RAS and WAS pumps and piping are divided into north and south sides, and both systems are housed together in the north and south galleries. The RAS pumps were re-built and equipped with new motors in 1997. The WAS pumps were completely replaced at this time. In general, GNHWPCA reported the RAS and WAS pumps are reliable and function well. Piping and equipment on the north side appeared to be in significantly poorer shape than the same on the south side. The entire north side area is in poor condition, including peeling wall paint and a very damp environment with standing water in places on the floor. Piping showed considerable rusting, paint peeling, and paint chipping. A number of the pump bases were severely deteriorated and the sump area also appeared to be in poor condition. During our site visit, RAS Pump No. 6 was vibrating excessively.

Piping and equipment on the south side appeared to be in much better condition than the north side, and the space had a cleaner and better-maintained appearance. We noted all pump shafts were equipped with shaft guards to provide additional safety. Piping in this area appeared to have been recently re-painted, and the walls and floor were in good condition. The exception was a large leak in one of the side walls, which was reportedly coming from a manhole immediately outside the area.

During our site visit, RAS Pump No. 4 had excessive seal leakage and was reported to have bad bearings. The pump was spilling a large amount of water onto the floor. RAS Pump No. 1 was out of service with a severely damaged impeller. At the time of our site visit, this pump had been out of service for a couple of weeks.

VFDs for the RAS and WAS pumps were replaced in 1997 and appeared to be in good condition. The 480 volt MCCs for these pumps are from the 1970s, and appeared to be reaching the end of their useful lives.

The secondary clarifier scum pits are equipped with isolation gates with electric actuators. These actuators appeared to be in good condition. Each pit is equipped with a submersible pump, which were reported to be reliable.

Recommendations

The following are recommendations for the secondary clarifiers based on our site visit observations:

- Consider planning for future replacement of secondary clarifier influent gate actuators and secondary clarifier sludge scraper mechanisms, as this equipment is nearing the end of its useful life.
- Repair deteriorated concrete areas of secondary clarifier walkways.
- Re-paint/ refurbish secondary clarifier walkway railing.
- Repair secondary clarifier expansion joints from the exterior of the tanks, and plan for interior tank inspections.
- Clean, repaint, and repair leaks on all walls, piping, and equipment in the north side RAS/WAS gallery.
- Repair RAS Pump Nos. 1, 4, and 6.
- Repair the wall leak into the south side RAS/WAS gallery.
- Plan to upgrade the MCCs for the RAS and WAS pumps.
- Continue to maintain equipment in a way that will minimize future downtime as equipment ages.

Risk Rating

In general, the secondary clarification process at the WPAF is in good condition and equipment downtime is minimal. Based on our observations, the reliability and adequate redundancy of the clarification equipment, and the lack of out-of-service equipment during our site visit, the secondary clarification process received a risk rating of 4 (little to no risk).

2.1.6. Disinfection System

After secondary clarification, wastewater enters two chlorine contact tanks. Sodium hypochlorite solution is injected into the flow prior to entering the tanks, and submersible mixing pumps in the influent channel mix the chlorine solution with the secondary effluent. Sodium hypochlorite is stored in two bulk storage tanks and fed into the wastewater stream with peristaltic-type chemical feed pumps. Both chlorine contact tanks are intended to be in service, although only one can be used if the other needs to be drained for service.

Actuators on the chlorine contact tank isolation gates were recently replaced and are in good condition. The sodium hypochlorite solution mixing pumps at the head of the chlorine contact tanks are also relatively new and in good condition. GNHWPCA staff reported that these mixing pumps are reliable and effective at mixing the sodium hypochlorite solution into the wastewater stream. Nitrate and ammonia analyzers on the chlorine contact tanks are also relatively new and function well. However, the chlorine analyzers were reported to require frequent maintenance.

The sodium hypochlorite bulk storage tanks and tank containment area are in excellent condition. However, the tanks do not have dedicated overflow pipes or drains. Consequently, to drain the tanks the feed pump suction lines would have to be broken. OMI should consider providing dedicated overflow and drain pipes, as this piping is good practice.

The sodium hypochlorite feed pumps are also quite new (installed in 2004) and in excellent condition. However, the feed pump containment area was full of standing water during our visit. The containment area should be drained to maintain adequate containment volume and checked routinely. Although the pumps are new, the pump pads and containment area showed signs of deterioration.

We also observed that the sodium hypochlorite fill station has no formal unloading spill containment area for the chemical delivery trucks. There is only a makeshift fill box. The station has minimal signage as well. The area should be equipped with standard chemical truck unloading containment, proper signage, and controls to permit fill operations and tank level monitoring from the fill station.

The exposed portions of the chlorine contact tanks, particularly the dividing wall between the tanks, showed signs of poor structural condition, with efflorescence, cracking and other forms of deterioration. GNHWPCA reported that the chlorine contact tanks were last drained approximately five years ago, and that concrete below the normal water surface was in good condition. As with the aeration tanks and secondary clarifiers, many expansion joints appeared from the exterior of the tanks to be in poor condition, and

repairs have already been made on a number of these joints. The chlorine contact tanks should be dewatered so that expansion joints can be inspected from the interior.

Recommendations

The following are recommendations for the disinfection process based on our site visit observations:

- Consider providing dedicated overflow and drain piping on the sodium hypochlorite bulk storage tanks.
- Begin planning for replacement of pump pads and the containment area for the sodium hypochlorite feed pumps.
- Upgrade the sodium hypochlorite truck unloading area to provide standard containment, proper signage, and controls to permit fill operations and tank level monitoring from the fill station.
- Repair exposed areas of chlorine contact tank concrete.
- Repair chlorine contact tank expansion joints from the exterior of the tanks, and plan for interior tank inspections.
- Continue to maintain equipment in a way that will minimize future downtime as equipment ages.

Risk Rating

In general, the disinfection process at the WPAF is in good condition with relatively new equipment, and equipment downtime is minimal. Based on our observations, the age and reliability of the disinfection system equipment, and the lack of out-of-service equipment during our site visit, the disinfection process received a risk rating of 4 (little to no risk).

2.1.7. Odor Control

There are four wet scrubber systems that provide odor control for the critical areas of the WPAF, as follows:

- AMBI Scrubber: This scrubber provides odor control for the main building, which includes the sludge holding tank, gravity thickeners, the main sewage pump wetwell and the thickened waste activated sludge (TWAS) tanks. This system is also referred to as the "Ambient" scrubber.
- RJ Scrubber: This scrubber provides odor control for the inlet works area beneath the covers of the grit channels and the lower levels of the bar screen channels.
- X-Flow Scrubber: This scrubber provides odor control for the air space above the grit tank covers and the building space above the bar screen channels.

- Paramount Scrubber: This scrubber system provides odor control for the primary clarifiers, including skimmings, and consists of two scrubber units.
- A fifth scrubber which handles solids handling areas is operated by Synagro.

Each scrubber system consists of a packed tower scrubber with associated chemical storage and feed systems, as well as associated fans and ductwork.

There is a large chemical storage and feed system for the RJ and Paramount scrubbers located in a wing of the headworks building. This area contains caustic soda and sodium hypochlorite chemical systems for the scrubbers. The unloading station for these chemical storage systems is located on the outside of this building, adjacent to the main plant entrance roadway. While there is no obvious formal chemical truck unloading containment area, the delivery area is sloped towards a central drain that directs any spilled chemical to the head of the plant. Chemical unloading quick-connects are located in a box that has containment inside of the building. The chemical tank level sensors outside of the building were hard to read and should be improved, so that the person unloading the chemical truck has a clear indication of how full the tanks are, to minimize tank overflow.

In general, the chemical feed and storage area appeared clean and well-maintained. There were plenty of slop sinks and eyewash/shower stations available. The chemical storage tanks appeared to be in good condition, with adequate spill containment. Piping, pumps, and tankage in this area were well labeled. Sample probes and analyzers for the scrubber systems appeared to be quite new and in good condition. Old scrubber control panels are in the process of being phased out by new modern panels. Air Handling Unit No. 1 for this area was out of service during our visit, although the ambient air quality seemed good. In this area there is an old air dryer system for instrument air that is no longer in service

The chemical feed pumps for the RJ Scrubber appeared to be reaching the end of their useful lives and were showing signs of wear. Some of the appurtenances on these pumps reportedly require frequent maintenance, including pressure gauges, pulsation dampeners and other such devices. The Paramount Scrubber recirculation pumps were vibrating significantly during our site visit, but these pumps were reported to operate well, although they are nearing the end of their useful lives. We understand that the older chemical feed pumps are being replaced with new peristaltic pumps. New peristaltic pumps were installed for the Paramount Scrubber and two new pumps have been procured, but not yet installed.

During our site visit, the RJ Scrubber was out of service due to a problem with the recirculation system. But, the scrubber reportedly had only been out of service since the previous day. This scrubber generally appeared to be in good condition and was reported

to operate well. Despite being out of service, we did not detect excessive odors from the grit channel area.

The Paramount scrubber system appeared to be in very good condition. This system was installed in 1999-2000. GNHWPCA staff reported that this system is generally well-maintained, with acid washing of the media being done two times per year. Expansion joints on some of the air piping were recently replaced. However, we noticed during the site visit that the insulation around the scrubber fans is in poor shape and needs to be repaired or replaced. The fans themselves seemed to have fairly high levels of vibration. OMI should analyze the vibration levels to make sure they are within allowable limits and vibration will not cause future issues. In general, GNHWPCA reported that this system operates well, and has no major issues.

Chemical day tanks for the AMBI scrubber are located adjacent to the end of the primary clarifiers. The day tanks have no formal containment area and the chemical feed pumps for the scrubber appeared to be reaching the end of their useful lives. In general, this area is in need of upgrade and had a sloppy appearance with a lot of old parts lying around the floors. Ductwork in this area appeared badly corroded. However, the chemical feed system itself was reported to operate adequately.

Recommendations

The following are recommendations for the odor control systems based on our site visit observations:

- The chemical tank level sensors outside of the building were hard to read and should be improved.
- Continue replacing old chemical feed pumps with more modern pumps.
- Continue regular maintenance on peristaltic pumps to minimize the potential for hose breakage.
- Continue to phase out old instrumentation in the main odor control chemical feed and storage area and replace it with modern instrumentation.
- Repair the air handling unit in the main odor control chemical feed and storage area.
- Consider replacing chemical feed pumps for the RJ Scrubber. Install the new pumps procured for the Paramount Scrubber.
- Continue to maintain the historically minimal downtime for the RJ Scrubber and bring it back into service quickly.
- Replace insulation around the scrubber fans.
- Analyze fan vibration levels.

- Upgrade and clean the area near the AMBI Scrubber day tanks and feed pumps and provide containment for the chemical day tanks.

Risk Rating

In general, most of the odor control systems and components were in satisfactory condition. Based on our observations, the small number of out of service equipment, and the relatively large amount of newer equipment, the odor control systems received a risk ranking of 3 (some risk). When the RJ Scrubber is back in service and the new Paramount Scrubber pumps are installed, the rating may improve to a 4 (little or no risk).

2.1.8. Solids Handling

Sludge from the primary clarifiers is pumped via six primary sludge pumps to a single gravity thickener. From the gravity thickener, thickened primary sludge is pumped via four thickened sludge pumps (two centrifugal and two piston type) to a sludge holding tank. Sludge is transferred from the holding tank to the sludge processing system, which is operated by Synagro and is thus not discussed in this report. The discharge pipe of the sludge holding tank is the dividing line between equipment operated by OMI and that operated by Synagro.

The WAS from the secondary clarifiers is pumped by the WAS pumps to the two gravity belt thickeners (GBTs). The GBTs thicken the WAS for transfer to the sludge processing system operated by Synagro. The thickened sludge is transferred via progressive cavity TWAS pumps operated by OMI.

Originally, the plant was equipped with three gravity thickeners for primary sludge thickening. However, two of these tanks were never equipped with covers for odor control, and thus were abandoned. The one remaining gravity thickener has not been upgraded since the mid-1980's, and appeared to be reaching the end of its useful life. The sludge collector mechanism was badly rusted and should be evaluated to determine if replacement is necessary in the short-term. Given that there is only one operable gravity thickener, any downtime associated with this piece of equipment would be detrimental to plant operations. The odor control cover on the gravity thickener was installed in the mid-1990's and appeared to be in good condition.

The gravity thickener underflow (thickened sludge) pumps are original from the 1970s and appeared to be in poor condition. Under normal operating conditions, only one of the centrifugal pumps is required to handle the thickened sludge loading. During our visit, only one of the centrifugal TSPs was available for service. The motor on the other centrifugal pump had been removed. If the thickened sludge concentration becomes too high, the piston pumps can be used. Although the thickened sludge pumps are old and corroded, we understand that they generally operate in an acceptable manner. The thickened sludge piping in this area also appeared to be quite corroded and in need of

replacement. GNHWPCA reported that upgrades to the thickened primary sludge pumping system are currently being planned, although the schedule for this work is not known.

The holding tank for thickened primary sludge is old and appeared to be in poor condition. In fact, during our site visit we were told by GNHWPCA staff not to walk on the tank roof as it is believed to be structurally unsound. While we do not know the extent of structural issues with this tank, given the snow loads that can accumulate on this tank, these structural issues should be addressed immediately, or at a minimum, a structural evaluation should be performed. We understand that there is a plan in place to convert this sludge holding tank to a second gravity thickener; however, we are not aware of the schedule for this work.

The WAS from the secondary clarifiers is sent to the two GBTs for processing. The GBTs appeared to be in good condition and were reported to function well. During our site visit, the south GBT was missing its scraper blade. OMI should replace this blade as soon as possible to ensure optimal operation of the GBT. Centrate from the GBTs was freely draining onto the floor, creating splashing and volatilizing odorous compounds. The sides of the GBTs were covered with plywood to control the splashing associated with this free-draining. While the plywood barriers were effective, OMI should consider piping the centrate to the floor drains to minimize odors and to reduce the housekeeping associated with this operation. The TWAS pumps appeared to be reaching the end of their useful lives, but were reported to be in good condition and to operate well.

Polymer is provided to the GBTs by a polymer system located near the units. The polymer feed and storage system appeared to be quite old, but was reported to be functional. The polymer feed pumps are not easily accessible for maintenance, as they are behind the polymer storage tanks in a tight area. In addition, there is no secondary containment for the polymer tanks. The dilution/make-up water system for the polymer located near the tanks was not in service. As the polymer system appears to be reaching the end of its useful life, OMI should consider upgrading this system in the near-term.

Recommendations

The following are recommendations for the solids handling systems based on our site visit observations:

- The sludge collector mechanism on the one operable gravity thickener should be evaluated to determine if replacement is necessary in the short-term.
- Quickly implement the plan to convert the sludge holding tank to a gravity thickener to provide some redundancy for the primary sludge thickening process. If this plan is not implemented quickly, evaluate the structural condition of the sludge holding tank roof to determine if it can handle the required loads.

- Quickly implement planned upgrades to the thickened primary sludge pumping system, including all pumps and piping.
- Replace the scraper blade on the south GBT
- Provide piping to route the GBT centrate to the floor drainage system.
- Consider planning for replacement of the GBT polymer feed system.

Risk Rating

With the exception of the lack of redundancy in primary sludge gravity thickening, the solids handling system generally has good equipment availability and redundancy, despite the age and remaining useful life of the equipment. Overall, the solids handling systems received a risk rating of 2 (significant risk).

2.1.9. Plant Electrical, General Structures, Security, & Grounds

While a detailed evaluation of plant-wide electrical systems by specialized electrical staff was not performed, electrical systems throughout the plant appeared to be in good condition. GNHWPCA did not report any major electrical problems during our site visit. It should be noted that main plant-wide electrical service and distribution equipment is scheduled to be replaced as part of the planned Wet Weather Capacity and Nitrogen Reduction Improvements Project. However, this upgrade may still be a few years out. The main transformers that feed the plant are owned by GNHWPCA and are not maintained by OMI. Some of the electrical equipment, such as the Substation 2 switchgear, are reaching the end of their useful lives. Gear in Substation 2 is scheduled for replacement in the upcoming upgrade. Additionally, the plant currently has very limited standby power generation capability. The existing generator was installed in the 1970s and is rated for only 300 kW, which is adequate for only incidental uses, such as plant lighting and instrumentation. As part of the planned upgrade, a much larger power generator system will be installed, which will be capable of serving all critical plant loads.

In general, the plant structures and grounds had a good appearance, and appeared to be well-maintained. The plant administration area and control room were neat and clean. OMI is in the process of phasing out the old master control panel, and all information is being migrated to SCADA for access at the main control room. Not all points available on the old control console have been migrated as of yet to SCADA. Modern telemetry was available for monitoring most remote pump stations. OMI recently installed a large-screen television to display SCADA information. This television is beneficial and gives supervisory staff an easy way of viewing critical information.

In general, HVAC systems and ventilation throughout the administrative and personnel areas was generally adequate, and no major HVAC issues were reported by GNHWPCA

staff in these areas. The air conditioning system that serves the main building, including the lab, control room and locker rooms was recently upgraded and appeared to be in good condition. The air conditioning system that serves the main sewage pump VFDs also appeared to be in good condition, although it is a bit older (approximately 8 years old). Air Handling Unit No. 2 was recently replaced. Air Handling Unit No. 4 appeared to be nearing the end of its useful life, but was reported to function well. OMI should consider replacing this unit in the near future. Ductwork and dampers for the main building appeared to be in generally good condition, and some of these items were recently replaced. However, many of the process areas lacked proper ventilation and had aged and deteriorated HVAC equipment, potentially leading to rapid corrosion of process equipment. Some of the doors throughout the plant should be replaced in the near-term. OMI should consideration replacing doors as painting and other routine maintenance work is done in each area.

The process control laboratory appeared orderly and well-maintained, with adequate work space. Some of the lab equipment and furniture appeared to be somewhat old, and upgrades may need to be made in the mid-range future. The plant also has a maintenance garage and a maintenance shop. The garage appeared to have light use and was orderly and spacious. The maintenance shop was noticeably crowded and was not as neat and orderly as other areas of the plant. This area does appear to be functional, and no imminent need for upgrade appeared to be necessary. The stairwell under the maintenance shop is noticeably in need of painting.

Security systems at the plant are relatively minimal. During normal business hours, the main front gate remains open. A guard booth is located next to the main gate, but it is not currently staffed. We understand that the main gate is locked outside of normal business hours. We recommend that consideration be given to increased security during business hours, such as installing a motorized sliding gate with keypad or card access and a means of allowing visitors into the WPAF via CCTV and communication with the control room. Given that the site on which the secondary treatment and disinfection processes reside is unstaffed, the gate to that site remains locked.

There are a large number of roadways within the two sites that connect processes and facilities to one another. Adjacent to many of these roadways are open grassed areas. A number of these grassed areas had old equipment, parts, debris, etc. stored on them, leaving a sloppy appearance. These areas should be cleared, and the materials reviewed to determine what should be disposed of, and what should be kept. The usable items should be stored within a warehouse and/or on storage shelves. These items should be inventoried and tracked as would other tools and spare parts.

Many of these roadways also appear to have poor drainage. We visited the site during a week of wet weather, although no heavy rains fell during our visit. Despite the lack of

on-going rain, many of the roadways had significant amounts of standing water, and some areas were even blocked by pools of water. This amount of standing water can restrict access within the plant and also become breeding areas for pests, such as mosquitoes that pose a health risk. Roadway drainage should be studied and plans should be made for drainage improvements throughout the plant. General condition of pavement on many roadways could also be improved.

The main city water feed piping into the plant appeared to be rusted and in need of painting. Eventual upgrade of this system, including the backflow preventer, may be necessary in the coming years.

The plant water system in the south side RAS and WAS gallery had new piping and strainers. However, Plant Water Pump No. 2 was vibrating significantly during our visit and may have an out-of-alignment shaft. Plant Water Pump No. 1 appeared to be in very poor condition and had not been re-painted recently like the other pumps. Plant Water Pump No. 3 appeared to be quite new and in excellent condition.

Note that a detailed structural evaluation of each structure was not performed as part of this scope and that only general observations of the condition of structures were made. However, in general non-process related structures appeared to be in good condition.

Recommendations

The following are recommendations for the general plant structures, security, and grounds based on our site visit observations:

- Continue to maintain good upkeep of the plant administration and laboratory facilities.
- Continue to maintain the grounds in good condition, but initiate a program to clean-up old parts and general debris stored on the grounds.
- Consider planning for the replacement of main building Air Handling Unit No. 4 in the near future.
- General painting throughout the plant should be increased, as there are numerous areas in need of repainting.
- Consider increasing security during business hours, such as installing a motorized sliding gate with keypad or card access and a means of allowing visitors into the WPAF via CCTV and communication with the control room.
- Roadway drainage should be studied and plans should be made for drainage improvements throughout the plant.
- Re-pave roadways in need of upgrade.

- Consider replacing doors as painting and other routine maintenance work is done in each area.
- Begin planning for eventual upgrade of the city water system, including the backflow preventer.

Risk Rating

Based on our observations, and the generally good condition of non-process plant structures and grounds, these areas received a risk rating of 4 (little to no risk).

2.2. Pump Stations Condition Inspection

Major component condition and maintenance observations for the GNHWPCA's 30 wastewater pump stations, James Street Siphon, and the Truman Wet Weather Storage Tank Facility are summarized in this section of the Report. Pump station information in this section is presented by groups, Large, Medium, and Small, according to the individual station design capacities. The James Street Siphon and Truman Wet Weather Storage Tank Facility observations follow the pump stations. Our observations, recommendations, and assigned risk ratings for the pump stations, James Street Siphon, and Truman Wet Weather Storage Tank Facility are based on our field inspections and discussions with GNHWPCA and OMI staff.

2.2.1. Large Pump Stations

The GNHWPCA owns a total of 4 large pump stations with design capacities ranging from 10,000 to 30,000 gpm in New Haven. The large pump stations include a pump/control building that houses the pump station controls, pumps, electrical equipment, and emergency generator if equipped. Two of the stations, Boulevard and East Street, also have separate inlet works buildings that contain bar screens and fine grit collectors. The following is a list of the large pump stations.

- Boulevard
- East Street
- Morris Cove
- State and Union Street

In general, the operating and maintenance condition of the large pump stations was fair, receiving an average risk rating of 2.5 (some to significant risk). Although the stations are generally designed with an adequate level of redundancy, we observed several critical pieces of equipment to be in poor or inoperable condition, older and in need of replacement, or subject to chronic failure. Furthermore, the large pump stations are a critical piece of the infrastructure and equipment failure could have significant consequences.

2.2.1.1. Boulevard Pump Station

The Boulevard Pump Station is the second largest pump station owned by the GNHWPCA. The pump station has a design capacity of 24,000 gpm. The pump station consists of a large building that includes a pump area and an inlet works area. The pump area houses the pump station controls, electrical equipment, boiler room, emergency generator, and a dry pit with 4 vertical centrifugal pumps. The inlet works area houses influent channels, 2 bar screens with conveyors, 2 fine grit collectors with conveyors, and a chemical odor control unit.

OMI reported during our inspection that the emergency generator and vertical centrifugal pumps were in good operating condition. Pump No. 2 was recently rebuilt, and all 4 pumps had recently received new VFDs. All 4 pumps are older. New protective guarding was also observed on the moving parts on all 4 pumps.

We observed significant amounts of ground water that had infiltrated into the pump area dry pit and caused severe corrosion of the pump discharge piping and pipe supports. OMI believed the source of the infiltration was a hole cored in the concrete wall for an electrical conduit on the intermittent level. The source of infiltration should be further investigated, and if determined to be an electrical conduit penetration, sealed with grout or appropriate building sealant (such as a SikaFlex product).

We observed the inlet works area equipment to be in poor condition during our inspection. The bar screens and fine grit collectors were severely corroded and rags were present on the equipment. Grit Unit No. 2 was not operational during the inspection. New protective guarding was also observed on the moving parts on coarse screens and grit collectors.

The interior of the inlet works area was mildly damp during the inspection. OMI reported that the ventilation system had recently been reactivated in the area. The odor control scrubber is not in use; however, OMI has received no odor complaints. There is also no gas monitoring system within the building requiring personnel to use portable hazardous gas detectors during entry.

Recommendations

The following are recommendations for the Boulevard Pump Station based on our site visit observations:

- Consider replacing the 4 vertical centrifugal pumps.
- Patch electrical conduit hole in intermittent level to stop water infiltration.
- Evaluate extent of corrosion on the pump piping and pipe supports, repair as needed.

- Evaluate ventilation needs and equipment at the Inlet Works Area, repair as needed.
- Consider the need to bring the odor control scrubber back into service.
- Consider replacing or upgrading the equipment within the Inlet Works Area.
- Install gas monitoring equipment in the Inlet Works Area.

Risk Rating

In general, the Boulevard Pump Station is in fair operating condition. Based upon our observations, the pump station received a risk rating of 2 (significant risk) as the operating and redundant equipment in the inlet works area is in poor condition. Because of the high volume of flow handled by the pump station, equipment failure could have significant consequences.

2.2.1.2. East Street Pump Station

The East Street Pump Station is the largest pump station owned by the GNHWPCA. The pump station has a design capacity of 29,166 gpm and pumps raw wastewater flows from New Haven to the WPAF for treatment. The pump station consists of a pump/control building and an inlet works building. The pump/control building houses the pump station controls, electrical equipment, 2 emergency generators, and 4 vertical centrifugal pumps. The inlet works building houses influent channels, 2 bar screens with conveyors, 2 fine grit collectors with conveyors, and a biochemical odor control unit. The pump station also had a portable rental generator on site during the inspection.

OMI reported during the inspection that the primary emergency generator had recently undergone repairs to resolve problems with the generator starting and charging. OMI was testing the generator to determine if the repairs had been effective. OMI reported that there were no issues during the testing to date. OMI also reported that the rental generator would be removed from the site at the conclusion of the testing.

The 4 vertical centrifugal pumps at the pump station are older, but appeared to be well maintained. During our visit, 3 of the pumps were in operable condition. The out-of-service pump, Pump No. 5, was being rebuilt. Of the 3 operable pumps, OMI reported that Pump Nos. 2 and 4 were rebuilt in 2005, and Pump No. 3 is scheduled to be rebuilt in the near future. Pump No. 3 had a seal water leak during our visit. New protective guarding was observed on the moving parts on all 4 pumps. (Note: There is no Pump No. 1 at the pump station).

The pump VFD's are scheduled for routine maintenance in the near future. OMI installed VFD drive cooling fans, which has resolved issues with overheating. OMI reported that the pump station PLC was operating properly since recent SCADA upgrades. The pump building is also scheduled for gas monitoring system installation in the near future.

We observed the inlet works building equipment to be in poor condition during our site visit. The bar screens and fine grit collectors were severely corroded and rags were present on the equipment. Grit Unit No. 1 and Coarse Screen No. 1 were not operational during our visit. New protective guarding was also observed on the moving parts on coarse screens and grit collectors.

The interior of the inlet works building was extremely damp during the inspection. Despite having installed 4 new blowers and a new exhaust fan, OMI was not operating the pump station ventilation system and odor control unit because of recent odor complaints. There is also no gas monitoring system within the building, requiring personnel to use portable hazardous gas detectors during entry.

Recommendations

The following are recommendations for the East Street Pump Station based on our site visit observations:

- Complete testing on emergency generator.
- Consider replacing the 4 vertical centrifugal pumps.
- Repair seal water leak on Pump No. 3.
- Complete scheduled VFD maintenance.
- Evaluate ventilation needs and equipment at the Inlet Works Building, repair as needed.
- Consider replacing or upgrading the equipment within the Inlet Works Building.

Risk Rating

In general, we observed the East Street Pump Station to be in fair operating condition. Based on our observations, the pump station received a risk rating of 2 (significant risk) as the operating and redundant equipment in the Inlet Works Building is in poor condition. The age of the pumps is also of concern. Because of the high volume of flow handled by the pump station, equipment failure could have significant consequences.

2.2.1.3. Morris Cove Pump Station

The Morris Cove Pump Station is a newly constructed facility brought online in 2006 to replace an existing pump station. The pump station has a design capacity of 12,500 gpm and pumps flows from one New Haven and two East Haven sewer interceptors to the East Shore WPAF for treatment. The pump station consists of a pump/control building that houses the pump station controls, electrical equipment, and emergency generator, 2 wet wells, a wet pit containing influent channels and channel grinders, a dry pit

containing 5 dry pit submersible pumps, and a biochemical odor control unit. The station also had a portable bypass pump on site during our visit.

The 5 dry pit submersible pumps at the pump station have had several maintenance and operating issues including seal and bearing failures since the pump stations inception. In June 2011, GNHWPCA entered a Professional Services Agreement with Malcolm Pirnie, Inc. to conduct an evaluation of influent channel and pumping system alternatives at the pump station to determine potential solutions for the ongoing pump issues.

During our inspection, there were no reported or observed operation or maintenance issues at the pump station. GNHWPCA reported that the pump station wet well ultrasonic level sensors were not online during our visit; however, the units have since been replaced with a pressure transducer.

Recommendations

The following are recommendations for the Morris Cove Pump Station based on our site visit observations:

- Complete evaluation of influent channel and pumping system alternatives.
- Continue to monitor and maintain the pumps and other equipment.

Risk Rating

In general, we observed the Morris Cove Pump Station to be well-maintained and in good operating condition, with the exception of the ongoing pump issues. Based on our observations, the pump station received a risk rating of 3 (some risk) as the deficiencies observed do not pose an immediate threat and the pump station's equipment is adequately redundant.

2.2.1.4. State and Union Pump Station

The State and Union Street Pump Station is an older pump station located in downtown New Haven. The pump station has a design capacity of 10,417 gpm and pumps flows from New Haven into a gravity sewer which leads to the East Street Pump Station. The pump station consists of pump/control building that houses the pump station controls, a dry pit with 4 vertical centrifugal pumps, and a wet well. There is no emergency power at the pump station.

OMI reported that the 4 vertical centrifugal pumps were in good operating condition. The pumps are all older and none of the pumps were operating during our visit. Pump No. 1 is no longer used due to inadequate capacity. New protective guarding was observed on the moving parts on all 4 pumps.

New maintenance valves were installed in the pump discharge piping for use in removing settled grit. Pump No. 3 had a new discharge isolation valve. Pump No. 2 had a leaking check valve. We observed some surface rust on the discharge piping and valves at all 4 pumps.

The pump station recently received a new control panel and communications equipment. OMI also reported that the wet well had been recently cleaned reducing the occurrence of pump clogging.

Recommendations

The following are recommendations for the State and Union Street Pump Station based on our site visit observations:

- Repair leaking check valve at Pump No. 2.
- Renovate pump station as part of a future project.

Risk Rating

In general, we observed the State and Union Street Pump Station to be satisfactorily maintained and in fair operating condition. Based on our observations, the pump station received a risk rating of 3 (some risk) as the deficiencies observed do not pose an immediate threat and/or equipment failure generally would not have significant consequences. However, due to the older equipment, the pump station should be considered for upgrades in the future.

2.2.2. Medium Pump Stations

The GNHWPCA owns a total of 6 medium pump stations with design capacities ranging from 1,200 to 5,000 gpm throughout New Haven and the surrounding communities. The medium pump stations are configured as either wet wells with submersible pumps (3 total) or wet pit – dry pits with vertical centrifugal or submersible pumps (3 total). The following is a list of the medium pump stations and their configuration.

Table 2-1:
Medium Pump Stations

Wet Well with Submersible Pumps	Wet Pit - Dry Pit with Vertical Centrifugal or Submersible Pumps
Barnes Avenue	Fairview Road
Long Wharf	State Street
Quinnipiac	Welton Street

All of the medium pump stations are scheduled for or have received station-wide renovations. We observed the stations to be well maintained and in good operating condition. We did not visit State Street Pump Station because renovations were scheduled to begin in June 2011. No significant structural defects were observed in the pump station wet wells or buildings. Note that we did not conduct a detailed structural and equipment analysis during the inspection.

The medium pump stations all received recent telemetry upgrades as part of an overall system-wide SCADA implementation. The improvements allow Operations and Maintenance personnel to remotely monitor the stations and receive notification of pump failures or other alarm conditions as they occur.

Recommendations

The following are recommendations for the medium pump stations and for individual pump stations within the group:

Medium Pump Stations (general)

- Continue routine maintenance on the stations.

Fairview Road

- Replace hatches on wet well influent channel.
- Evaluate HVAC needs in dry pit to reduce moisture, implement measures as needed.
- Inspect flat roof on above ground building.
- Trim tree limbs near RBAS antenna as needed.
- Inspect masonry walls on above ground building, repair as needed.

Long Wharf

- Evaluate corrosion on wet well walls, repair as needed.

Welton Street

- Increase size/capacity of 10-in gravity main to accommodate discharge from 10-in forcemain.

Risk Rating

In general, we observed the medium pump stations to be well maintained and in good operating condition. Based on our observations, the medium pump stations received an average risk rating of 3.7 (no/some risk) because the deficiencies observed did not pose an immediate threat. However, due to the considerable flows the stations experience, equipment failure and/or deterioration of the pump stations could be cause for significant

financial and environmental consequences. Therefore, maintenance of the pump stations is essential.

2.2.3. Small Pump Stations

The GNHWPCA owns a total of 20 small pump stations with design capacities ranging from 90 to 875 gpm throughout New Haven and the surrounding communities. The small pump stations are configured as either wet wells with submersible pumps (11 total), below grade can stations with vertical centrifugal pumps (6 total), or wet pit – dry pits with vertical centrifugal pumps (3 total). The following is a list of the small pump stations and their configuration.

Table 2-2:
Small Pump Stations

Wet Well with Submersible Pumps	Below Grade Can Station with Vertical Centrifugal Pumps	Wet Pit - Dry Pit with Vertical Centrifugal Pumps
Cosey Beach	Humphrey Street	Arch Street
Fort Hale	Lovell Street	Mill Rock
Main Street	Mitchell Drive	Whitneyville
Market Street	Old Chauncey Road	
Meadow Street	Putnam Avenue	
Minor Road	Woodbridge	
New Grand Avenue		
Old Grand Avenue		
Stone Street		
Upper Thomson Street		
West Rock		

Several of the small pump stations are scheduled for or have received station-wide renovations. No significant structural defects were observed in the station wet wells, buildings, or can stations. Some of the stations had older pumps and generators; however, most of them were reported or observed to be in operable condition. Those that were not operational were reportedly scheduled for repair. Note that we did not conduct a detailed structural and equipment analysis during the inspection.

The majority of the small pump stations received recent telemetry upgrades as part of an overall system-wide SCADA implementation. Several stations also received new control panels and gas detection equipment that are tied in to the SCADA system. The improvements allow Operations and Maintenance personnel to remotely monitor the stations and receive notification of pump failures or other alarm conditions as they occur.

Recommendations

The following are recommendations for the small pump stations and for individual pump stations within the group:

Small Pump Stations (general)

- Consider replacing can stations with submersible stations as part of future projects.
- Consider replacing older pumps and generators as needed.
- Install amp meters to monitor pump clogging at applicable pump stations where not already installed. (i.e., Stone Street, Mill Rock, Lovell).

Cosey Beach

- Inspect flat roof on above ground building, repair as needed.
- Inspect masonry walls on above ground building, repair as needed.

Fort Hale

- Paint building interior walls and ceiling.
- Inspect flat roof on above ground building.
- Repair concrete step at entrance of building.

Main Street

- Make repairs to pump station in conjunction with DOT work.
- Continue to monitor wet well grease, clean as needed.

Meadow Street

- Inspect flat roof on above ground building, repair as needed.
- Repair oil leak on emergency generator.

Mitchell Drive

- Repair/replace Pump No. 1 seal water leak.

Old Grand Avenue

- Complete pump repair and reinstallation.

Upper Thompson Street

- Repair/replace sump pump in valve chamber.
- Evaluate if frequency of wet well cleaning is sufficient; clean wet well as part of routine maintenance.
- Retrieve pump lifting chain from wet well.

West Rock

- Evaluate need for bypass piping; repair as needed.

Risk Rating

In general, we observed the small pump stations to be well maintained and in good operating condition. Based upon our observations, the small pump stations received an average risk rating of 3.2 (some risk) because the deficiencies observed did not pose an immediate threat and/or an equipment failure generally would not have significant consequences.

2.2.4. Truman Wet Weather Storage Tank Facility

The Truman Wet Weather Storage Tank Facility is located in New Haven upstream of the Boulevard Pump Station. The newly constructed facility consists of a 5 million gallon underground storage tank and a control building. The tanks store excess flow incurred during wet weather events until it can be processed by the Boulevard Pump Station.

OMI reported that there have been no operating problems with the Truman Wet Weather Storage Tanks since inception. However, OMI has received a small number of odor complaints from the local community. No odor was detected during the inspection.

We observed the control building to be in good condition during the inspection. The building is located adjacent to a public school and playground where children were playing in close proximity to the building. There is no fencing around the building; however, the building has locked metal doors and is in an open area that should deter entry.

Recommendations

The following are recommendations for the Truman Wet Weather Storage Tank Facility based on our site visit observations:

- Evaluate the facility's odor control needs; repair as needed.
- Continue to monitor the facility for security purposes.

Risk Rating

In general, we observed the Truman Wet Weather Storage Tank Facility to be well maintained and in good operating condition. Based on our observations, the facility received a risk rating of 4 (little to no risk) as the operating equipment is in good condition and an equipment failure would not have significant consequences.

2.2.5. James Street Siphon

The James Street Siphon is a sanitary sewer siphon that carries flows across the Quinnipiac River from New Haven to the WPAF. The siphon consists of 3 barrels (two 18-in. and one 12-in.), and an inlet works building that houses bar screens and other miscellaneous equipment.

In coordination with the building of a new bridge crossing the river on I-95, OMI recently relocated the siphon barrels to facilitate construction. GNHWPCA reported that the barrels were in good condition.

GNHWPCA reported that a new roof had recently been installed on the inlet works building. The building also had a new gas monitoring system and radio-based communications equipment as part of SCADA upgrades.

The interior of the inlet works building was noticeably damp during the inspection. GNHWPCA reported that the condensate pump in the basement was suspected to be leaking. Moreover, the basement sump was not operational. Consequently, the basement was flooded, and we could not enter to complete our inspection. Bar Screen No. 2 also was not operable. The GNHWPCA reported that the bar screen failure was a chronic issue.

Recommendations

The following are recommendations for the James Street Siphon based on our site visit observations:

- Evaluate the mechanical condition of the bar screens; repair or replace as needed.
- Repair or replace the condensate pump in the inlet works building basement.
- Repair or replace the sump pump in the inlet works building basement.
- Evaluate the inlet works building ventilation needs and equipment; repair as needed.

Risk Rating

In general, we observed the James Street Siphon equipment to be poorly maintained and in fair operating condition. Based on our observations, the siphon received a risk rating of 2 (significant risk) as the operating and redundant equipment in the inlet works building is in poor condition. Because of the high volume of flow handled by the siphon, equipment failure could have significant consequences.

2.2.6. Adherence to Schedule 15

Schedule 15 of the Agreement summarizes the minimum pump station repairs and upgrades deemed necessary for OMI to meet the terms and conditions of the Agreement. The schedule provides some specific repairs for each of the New Haven pump stations as well as general repairs for all pump stations. Schedule 15 recommendations include such actions as bringing electrical and ventilation systems to code, repairing odor control units, repairing equipment leaks, maintaining structures, and improving housekeeping. Based on our review observations there are numerous examples detailed in the previous pump station sections that demonstrate OMI's slow progress towards meeting to the repair requests identified under Schedule 15. For instance, electrical, ventilation, and odor control systems are in poor condition and have not been upgraded or repaired. And, general housekeeping observations at the Boulevard, East Street, and James Street Siphon were not in accordance with the intent of the Agreement.

OMI's recent telemetry upgrades at most stations as part of the SCADA implementation project are one of the requirements of Schedule 15. We did not confirm if OMI completed the specific repairs identified for each of the New Haven pump stations.

2.3. Maintenance Information Management

In 2009, GNHWPCA purchased a new "out-of-the-box" web-based solution called Maintenance Connection to replace its existing computerized maintenance management system (CMMS) called Datastream MP2. The MP2 platform had become obsolete within the industry; thus, OMI recommended the purchase of Maintenance Connection. Maintenance Connection is OMI's standard CMMS software at its contract operated facilities. Similar to the MP2 system, Maintenance Connection is used to manage the asset and maintenance data of the System (WPAF and pump stations) and satisfy the maintenance data management requirements put forth by the Agreement. According to the Agreement, OMI shall:

"... provide, program, install and maintain a fully functional computerized maintenance system which shall be capable of and shall perform the following function with respect to the System through the term of this Agreement: (A) track, record and describe repairs performed; (B) establish and schedule a predictive and preventive maintenance program; (C) establish a program to monitor and schedule a corrective maintenance program: (D) maintain and continuously update a spare parts inventory; and (E) establish, maintain, and update schedule prioritizing necessary and appropriate repairs."

Our objective was to evaluate the availability and completeness of maintenance data within the CMMS to better understand OMI's current use of the system. Our observations were made during two separate field visits, June 22, 2011 and July 8, 2011. During these visits we met with both OMI and GNHWPCA representatives and reviewed

the data available within the CMMS. Our review focused on equipment identified on GNHWPCA's Critical Equipment List.

GNHWPCA reported that during the migration of existing preventive maintenance tasks into the new CMMS, many inconsistencies were identified. The GNHWPCA acknowledged that it is a work in progress and additional data clean-up is required. Slowly, standard preventive maintenance (PM) tasks are being created and applied to equipment to standardize PM tasks. An estimated 80% of assets at the WPAF are currently associated with the appropriate PM tasks. Vendor O&M manuals are being scanned and applicable maintenance instructions appended to the PM tasks. It is worth noting that predictive maintenance (PdM) tasks are not currently entered or tracked via CMMS, nor are spare parts.

During our review we identified specific activities that must be completed to move forward with the system implementation and address GNHWPCA's critical equipment data needs. We understand GNHWPCA retained CH2MHILL to perform these activities:

- Review the Critical Equipment List developed by the GNHWPCA.
- Identify all components within the CMMS that belong to equipment on the Critical Equipment List.
- Electronically link (associate) all the identified components to their respective critical equipment within CMMS.
- Work with GNHWPCA to obtain vendor O&M manuals for critical equipment and their components and identify all required PM tasks.
- Enter and/or edit existing PM tasks within CMMS as required per GNHWPCA direction or vendor O&M manual requirements.
- Scan required PM instructions, schematics, or general documentation from vendor O&M manuals into the CMMS and link the scan to critical equipment and their components.
- Confirm that all *Priority Action* settings within CMMS are properly set for all Critical Equipment and their components.
- Confirm that *Priority Action* settings are being used to initially assign the *Target Date* for PM task completion.
- Represent the GNHWPCA in discussions with Maintenance Connection (MC). Assist the GNHWPCA in developing a Scope of Work for Maintenance Connection. Scope of Work will include the development and implementation of Critical Equipment Dashboard tracking metrics that correspond with the proposed contract renewal key performance indicators (KPIs).

The overall capabilities of the system appear promising. Data within the new system uses a hierarchical structure created by GNHWPCA based primarily on location. This

hierarchy will eventually allow GNHWPCA to roll up costs and report data by cost centers, by building, by treatment area, and/or by equipment type as needed. Staff cost rates and subcontractor information was added to the system and can be modified to allow for financial tracking and reporting. In addition, Maintenance Connection allows customized security rights to the CMMS so that GNHWPCA can manage employee access rights to individual data. If implemented as intended, the CMMS will become an integral tool to manage the GNHWPCA's System assets.

Unfortunately, progress on implementing and completing data entry into the system has been prohibitively slow. To improve the effectiveness of its preventive maintenance program, OMI should take more responsibility for the outcome of this effort. Currently, the lack of time and personnel resources is the primary challenge to populating and maintaining the CMMS data. GNHWPCA and OMI are currently negotiating to hire a Maintenance Clerk to assist with these tasks.

2.4. Large Diameter Sewer Cleaning

Approximately 40 miles of the collection system is interceptor piping sized between 36 inches and 72 inches in diameter. These large diameter interceptors tend to collect significant amounts of grit and heavy debris. Therefore, it is important to inspect and clean these lines as required to maintain uninterrupted flow capacity and minimize CSO discharge events. Under Schedule 2 of the Agreement, OMI is required to clean and maintain all sewer mains in the collection system. Schedule 2 states that:

"All sanitary and combined sewer mains and manholes shall be jetted and/or cleaned and maintained free of blockages at a minimum of once every three years or more frequently as required."

In 2004, OMI agreed to evaluate the specific requirements and effective methods for establishing a cleaning program for these large interceptors. OMI submitted a plan to the GNHWPCA, but it is our understanding that to date the large diameter sewers have not been cleaned.

Table 2-3:
Risk Priority Rating System

Risk Rating	Risk Rating Criteria
1	**High Risk** - No redundancy - Operating Equipment in poor condition - If equipment fails, consequences are severe (such as potential threat to human health, permit violation, or significant repair expenditure)
2	**Significant Risk** - Some redundancy - Operating and redundant equipment in poor condition - Equipment failure may have significant consequences
3	**Some Risk** - Adequate redundancy - Operating equipment is adequately maintained - Equipment failure will not negatively affect the process
4	**Little to No Risk** - Available redundancy - Operating equipment in good to excellent condition - Equipment failure unlikely or w/ little consequence to the process - Functionally equivalent to a new facility

Table 2-4:
Treatment Plant Condition Summary

Process	System Components	Risk Rating[1]
Grit & Screening	2 mechanical bar screens/rakes 1 manual bar rack 2 screen conveyors/1 central conveyor 4 grit tanks 4 grit elevators 2 grit classifiers/grit conveyors 4 grit blowers	2
Primary Clarifiers	3 primary clarifiers 6 collector drives 2 primary scum pumps 1 scum trough 1 primary scum well	2
Main Sewage Pumps	5 main sewage pumps	3
Activated Sludge	4 aeration tanks 2 anoxic zone tanks 5 blowers 8 NRCY pumps	3
Secondary Clarifiers	8 final settling tanks 10 RAS pumps 10 WAS pumps 4 secondary scum pumps 3 plant water pumps 2 dewatering pumps	4
Disinfection	2 chlorine contact tanks 4 metering pumps 3 standby pumps (old hypo system) 2 chemical storage tanks	4
Odor Control	RJ scrubber Inlet works scrubber Paramount scrubber AMBI scrubber Associated equipment (pumps, tanks, etc.)	3
Solids Handling	3 gravity thickeners (2 small; 1 large) 2 sludge holding tanks 6 primary sludge pumps 2 gravity belt thickeners 2 TWAS pumps 4 sludge transfer pumps 2 polymer pumps	2

[1] Risk Priority Rating. See Table 2-3 for detailed rating criteria.

Table 2-5:
Large Pump Stations and James Street Siphon

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Boulevard	2	- Above ground building with pump station controls, emergency generator, and inlet works bar screens and collectors - Below grade dry pit with 4 vertical centrifugal pumps - Chemical odor control unit on site	- New VFDs for all 4 pumps - Recent SCADA upgrade - Pump No. 2 recently rebuilt - New safety guards on working parts of pumps and bar screens - Groundwater infiltration where electrical conduit enters building; causing excess corrosion of piping and pipe support in basement - Blower No. 3 in odor control room being rebuilt - Ventilation in inlet works building is good; recently restarted - Extensive corrosion on inlet works building equipment - Drop ports on coarse screen conveyors clogged - Fine Screen No. 2 not operational - No gas monitoring system at inlet works building - Odor control unit not used; not necessary
East Street	2	- Above ground emergency generator building with electrical equipment and emergency generator - Above ground pump building with 5 vertical centrifugal pumps and pump controls - Above ground inlet works building with bar screens and grit collectors - Chemical odor control unit on site - Portable emergency generator on site during generator repairs	- New controls installed for emergency generator to repair problem with starting - Recent SCADA upgrade at pump station - Pump No. 5 being repaired/rebuilt - Pump No. 3 has seal water leak; scheduled for repair - Pump No. 2 and No. 4 rebuilt since 2005 - New VFD cooling fans - Pump VFD's scheduled for maintence - New safety guards installed on pump and bar screen moving parts - No gas monitoring system in inlet works bldg; upgrade scheduled - Poor ventilation in inlet works bldg; blowers & odor control unit not operating - Paint peeling on inlet works building walls and ceiling - Extensive corrosion on bar screens and conveyors, rags and debris on screens - Fine Grit Unit No. 1 not operational - Coarse Grit Screen No. 1 not operational

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Morris Cove	4	- Above ground control building with pump station controls and emergency generator - Below grade dry pit with 5 submersible pumps - Below grade wet pit with 2 channel grinders - Biochemical odor control unit on site	- New pump station - Pumps have had chronic operating problems (bearing and seal failures) - Portable bypass pump on site - Wet well level indicator not connected during inspection
State and Union Street	3	- Above ground control building with pump station controls and emergency generator - Below grade dry pit with 3 vertical centrifugal pumps - Below grade wet well	- New pump station control panel - New radio communications system - Wet well cleaned since 2005 - New safety guards on pump moving parts - Pump No. 2 discharge check valve is leaking - Pump No. 1 undersized; operational but not in use - New discharge isolation valve at Pump No. 3
James Street	2	- Above ground building containing bar screens at influent of 3 siphon barrels	- New radio based alarm system - New gas monitoring system - New roof on building - Bar Screen No. 2 undergoing repairs - Poor ventilation in building - Extensive corrosion of equipment - Wet floor in basement; suspected seal leak on condensate pumps - Sump pump in basement not operational

[1] Risk Priority Rating. Please see Table 2-3 for detailed rating criteria

Table 2-6:
Medium Pump Stations

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Barnes Avenue	4	- Above ground building with pump station controls and emergency generator - Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Carbon odor control unit on site	- Pump station recently renovated; new pumps, new building, new emergency generator, new controls and electrical equipment; new odor control unit
Fairview Road	3	- Above ground building with pump station controls and emergency generator - Below grade dry pit with 3 submersible pumps - Below grade wet well	- New pump recently installed - New radio communications system - New gas monitoring system - New pump station flow meter - Buried emergency generator fuel tank being cleaned due to algae - Dry pit floor damp, concrete in good condition - Hatches on wet well influent channel rusted, scheduled for replacement - Gaps between mortar and block observed in masonry walls on above ground building - Tree limbs adjacent to pump station growing near radio communications system antenna
Long Wharf	4	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Weather-proof cabinet with pump station controls	- Minor concrete deterioration of wet well walls
Quinnipiac	4	- Above ground building with pump station controls and emergency generator - Below grade wet well with 4 submersible pumps - Below grade dry pit with pump discharge valves - Carbon odor control unit on site	- Pump station recently renovated; converted from vertical centrifugal pumps to submersible pumps, new building, new wet well, new emergency generator, new controls and electrical equipment; new odor control unit

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
State Street	N/A	- Above ground control building with pump station controls and emergency generator - Below grade dry pit with 3 vertical centrifugal pumps - Below grade wet well	- Complete station renovation scheduled to begin in June 2011
Welton Street	4	- Above ground control building with pump station controls and emergency generator - Above ground pump building accessing below grade dry pit with 2 vertical centrifugal pumps - Below grade wet well with channel grinder	- Pump station renovated in 1999; new building, pumps, emergency generator, electrical equipment and controls. - Pump station 10-in force main discharges to 10-in gravity main

[1] Risk Priority Rating. Please see Table 2-3 for detailed rating criteria

Table 2-7:
Small Pump Stations

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Ansonia Road	4	- Below grade can station with 2 vertical centrifugal pumps - Below grade wet well - Weather-proof cabinet with pump station controls - Outdoor emergency generator	- New pump station control panel - New radio communications system - New pump discharge valves - Can station appears dry and clean
Arch Street	3	- Above ground building with pump station controls and emergency generator - Below grade dry pit with 2 vertical centrifugal pumps - Below grade wet well	- New pump station control panel - New radio communications system - New gas monitoring system - New roof and gutters on control building - New doors and windows on control building - New interior paint in first and second floor - Older emergency generator and electrical equipment - Scheduled for renovations in 2014
Cosey Beach	3	- Above ground building with pump station controls and emergency generator - Below grade wet well with 2 submersible pumps	- New radio communications system - New gas monitoring system - New stainless steel wet well covers - New unit heater - New pump station bypass valve - Older emergency generator - Gaps between mortar and block observed in masonry walls on above ground building
Fort Hale	3	- Above ground building with pump station controls - Below grade wet well with 2 submersible pumps - Below grade dry pit with pump discharge valves - Emergency power supplied via portable generator	- New pump control panel - New radio communications system - New gas monitoring system - New pump discharge check valves - Concrete step at pump station entrance corroded - Peeling paint on control building ceiling - Wet well appears to be in good structural condition

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Humphrey Street	3	- Below grade can station with 2 vertical centrifugal pumps - Below grade wet well - Weather-proof cabinet with pump station controls	- New pump station control panel - New radio communications system
Lovell Street	3	- Below grade can station with 2 vertical centrifugal pumps - Below grade wet well - Below grade valve chamber with pump discharge and bypass valves - Weather-proof cabinet with pump station controls - Outdoor type generator	- New radio communications system - New gas monitoring system - Pump plugging occurring less frequently
Main Street	2	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Weather-proof cabinet with pump station controls - Odor control unit on site	- New radio communications system - Minor grease in wet well (Diner upstream of pump station) - Corrosion and water observed on valves in valve chamber - DOT work to commence on bridge adjacent to pump station, may affect pump station location
Market Street	4	- Below grade wet well with 2 submersible pumps - Weather-proof cabinet with pump station controls	- New radio communications system
Meadow Street	3	- Above ground building with pump station controls and emergency generator - Below grade wet well with 2 submersible pumps	- New radio communications system - New gas monitoring system - New stainless steel wet well hatch - New unit heater - Older emergency generator, small oil leak observed - Some grease observed on wet well walls

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Mill Rock	2	- Above ground control building with pump station controls and emergency generator - Below grade dry pit with 2 vertical centrifugal pumps - Below grade wet well	- New pump station control panel - New radio communications system - New gas monitoring system - Scheduled for renovations in 2013 - Occasional pump plugging - Hole in building ceiling - Building's brick walls are cracked and broken - Surface corrosion observed on pumps and piping - Minor grease and corrosion in wet well
Minor Road	3	- Above ground building with pump station controls and emergency generator - Below grade wet well with 2 submersible pumps	- New bypass connection - Mild deterioration of concrete in wet well - Mild grease build-up on wet well walls - Birds nest in air supply louver
Mitchell Drive	3	- Below grade can station with 2 vertical centrifugal pumps - Below grade wet well - Weather-proof cabinet with pump station controls	- New pump station control panel - New radio communications system - Wet floor in can station; Pump No. 1 seal leaking
New Grand Avenue	4	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Weather-proof cabinet with pump station controls	- New radio communications system
Old Chauncy Road	4	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Weather-proof cabinet with pump station controls - Outdoor emergency generator - Carbon odor control unit on site	- Newer pump station, no issues observed
Old Grand Avenue	3	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge valves - Weather-proof cabinet with pump station controls	- New radio communications system - 1 pump being repaired / pump rails to be repaired - Pump discharge valves cleaned in 2010

Pump Station	Risk Rating[1]	Station Configuration	Upgrades / Issues / Observations
Putnam Avenue	4	- Below grade can station with 2 vertical centrifugal pumps - Below grade wet well - Weather-proof cabinet with pump station controls	- New pump station control panel - New radio communications system - New gas monitoring system - New can station - Recent and continued development in upstream sewer shed
Stone Street	3	- Below grade wet well with 2 submersible pumps - Weather-proof cabinet with pump station controls	- New pump station control panel - New radio communications system - 1 new pump; 1 pump recently rebuilt - New issue with pumps clogging due to rags; suspect nearby apartment complex.
Upper Thomson Street	3	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge and bypass valves - Weather-proof cabinet with pump station controls	- New rails installed for submersible pumps - Sump pump in valve chamber not operational - Heavy grease in wet well - Pump lifting chain fallen into wet well
West Rock	4	- Below grade wet well with 2 submersible pumps - Below grade valve chamber with pump discharge and bypass valves - Weather-proof cabinet with pump station controls	- New pump station control panel - New radio communications system - New pump discharge valves - New stainless steel wet well access hatch
Whitneyville	3	- Above ground control building with pump station controls and emergency generator - Below grade dry pit with 2 vertical centrifugal pumps - Below grade wet well	- New radio communications system - New gas monitoring system - Scheduled for renovation in 2012

[1] Risk Priority Rating. Please see Table 2-3 for detailed rating criteria

3. System Management and Performance

3.1. Treatment Plant Environmental Compliance

In accordance with the Agreement, OMI is responsible for maintaining compliance with all applicable federal, state, and local regulations and permits. The Agreement states that OMI shall:

"...operate and maintain the System in accordance with all applicable federal, State, and local regulations pertaining to wastewater treatment standards,...[OMI] shall operate the System to be in compliance with the specific performance standards described herein, and shall satisfy the contract limits established by the [GNHWPCA] which are more stringent than existing NPDES limits."

This section of the Report focuses on OMI's management of the System through its compliance with the National Pollutant Discharge Elimination System (NPDES) Permit, State General Permit, and performance criteria set forth in the Agreement between the GNHWPCA and OMI.

Pirnie reviewed operations data provided by GNHWPCA and OMI for the period of April 2009 through April 2011, as available. The operations data reviewed included Discharge Monitoring Reports, electrical invoices, and various reports included in OMI's Monthly Operating Reports.

3.1.1. NPDES & General Permits

Pirnie reviewed selected performance parameters indicative of the WPAF's treatment performance, including flow characteristics, effluent BOD, TSS, fecal coliform counts, total nitrogen, chlorine residual and other information provided in OMI's Monthly Operating Reports. These specific parameters are directly linked to the NPDES and General Permits and provide an indication of overall WPAF treatment performance.

3.1.1.1. Wastewater Flow Characteristics

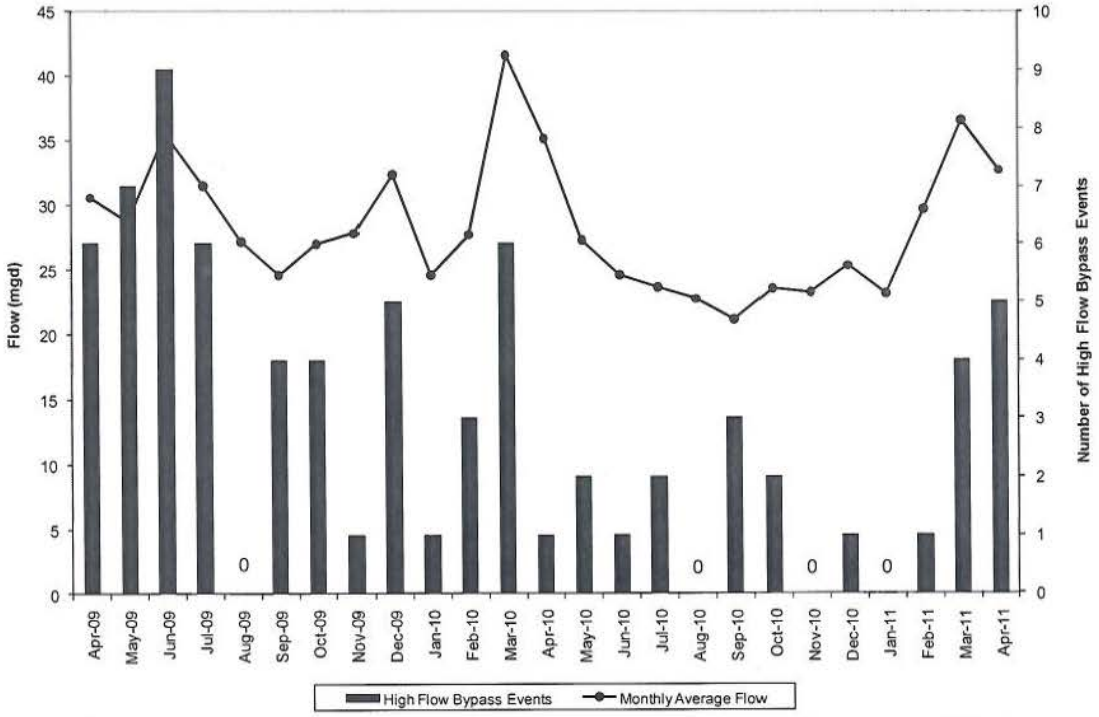
The average daily high and low flows along with the average daily flow provide an indication of the WPAF loading and show the typical daily flow range. Because the GNHWPCA operates a combined sewer collection system, flow rates are impacted by rainfall events and can be highly variable.

The WPAF provides primary and secondary treatment for all wastewater influent up to 60 mgd. During high flow events, events in which the WPAF influent flows exceed 60 mgd (the dry weather permit limit is 40 mgd), all flow receives primary treatment. However, flow exceeding 60 mgd bypasses secondary treatment and proceeds directly to

the disinfection system where it is disinfected along with the secondary effluent prior to discharge. The combined stream of primary effluent and secondary effluent must meet NPDES permit limits. Figure 3-1 indicates the average monthly flow and the number of high flow bypass events during the period of April 2009 through April 2011.

Wastewater flow characteristics are useful when evaluating other parameters, because flows often coincide with other observations. The number of high flow bypass events is included on this graph because these events can adversely affect the effluent quality.

Figure 3-1: Wastewater Flow Characteristics[1]



[1]Flows and bypass events from OMI Monthly Operating Reports, April 2009 – April 2011.

3.1.1.2. BOD, TSS and Fecal Coliform

The New Haven region experienced a number of wet weather events during the period of April 2009 through April 2011 that resulted in influent flows exceeding 60 mgd. The NPDES Permit Table A, Footnote No. 1 states that the *"Maximum Daily Limit of 50.0 mg/l BOD and 50.0 mg/l Total Suspended Solids are waived during periods when the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 60 mgd."* Therefore, all BOD and TSS samples that exceed 50.0 mg/l that occur during influent flows over 60 mgd are not Permit

exceedances. There were 16 days during this period when the maximum daily permit limit for BOD and TSS set forth by the NPDES permit was waived. However, all incidents of fecal coliform counts greater than 2,400 colonies/100 ml sample are Permit exceedances regardless of influent flows.

Table 3-1 below summarizes OMI's Permit exceedances for BOD, TSS, and fecal coliform counts, as well as incidents over 50.0 mg/l for BOD and TSS during high flow events (>60 mgd) during the period of April 2009 through April 2011. The NPDES permit requires OMI to indicate on the Discharge Monitoring Reports (DMRs) when such exceedances occur. During this period, OMI had a total of 2 Permit exceedances (1 BOD, 1 TSS) on April 27, 2010. On that day, OMI reported that a moderate rain event overloaded the secondary clarifiers resulting in some solids loss, which it believes contributed to the excursions. Descriptions of effluent BOD, TSS, and fecal coliform wastewater parameters are provided below Table 3-1.

Table 3-1:
Incidents and Exceedances for BOD, TSS, and Fecal Coliform[1]

BOD			
Date	**Value (mg/l)**	**Daily Permit Limit (mg/l)**	**Permit Exceedance**
4/21/2009	197.6	50	-
7/21/2009	71.1	50	-
3/23/2010	89.1	50	-
4/27/2010	82.4	50	Yes
4/13/2011	73.8	50	-
TSS			
Date	**Value (mg/l)**	**Daily Permit Limit (mg/l)**	**Permit Exceedance**
4/21/2009	175.0	50	-
7/21/2009	108.4	50	-
9/24/2010	93.4	50	-
9/25/2010	63.7	50	-
9/26/2010	64.6	50	-
3/23/2010	77.4	50	-
4/27/2010	76.6	50	Yes
5/18/2010	103.6	50	-
5/19/2010	58.6	50	-
7/13/2010	55.0	50	-
10/1/2010	100.2	50	-
2/25/2011	124.0	50	-
2/28/2011	62.0	50	-
3/6/2011	154.1	50	-
3/7/2011	107.3	50	-
4/13/2011	73.3	50	-
4/23/2011	117.6	50	-
Fecal Coliform			
None	-	-	-

[1] Incidents and exceedances from OMI Discharge Monitoring Reports, Apr 2009 – Apr 2011.

Effluent BOD: Effluent BOD is a measure of the organic material remaining in the wastewater after treatment and is expressed in terms of the oxygen required to fully stabilize or breakdown the organic material present in the water. This parameter is most closely linked to the performance of the secondary treatment process, specifically the aerated activated sludge tanks where most organic material is consumed by microbes.

For the majority of the period from April 2009 through April 2011, effluent BOD levels were well below Permit limits, as shown in Figure 3-2. As previously mentioned, the WPAF experienced a single BOD permit exceedance on April 27, 2010. However, the monthly average effluent BOD was 7.6 mg/l in April 2009 - March 2010 and 7.8 mg/l during the period of April 2010 - March 2011, indicating that WPAF performance has been consistently high in the last two years. Seasonal peaks for BOD during both periods are visible in Figure 3-2 and generally coincide with increased plant influent flows. BOD levels were also below the Agreement limits during the period of April 2009 through April 2011. Permit and Agreement limits are summarized below.

Permit limits: *30 mg/l monthly average; 50 mg/l daily maximum*

Agreement limits: *25 mg/l maximum monthly concentration; 20 mg/l average annual concentration based on a 12 month moving average.*

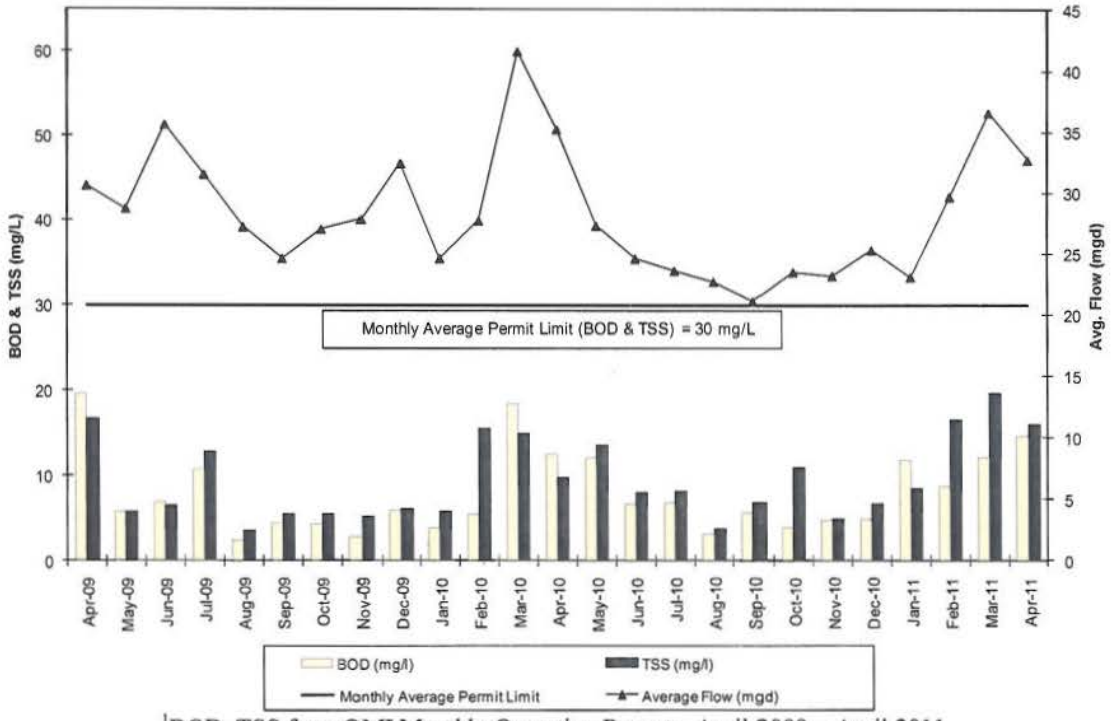
Effluent TSS: Effluent TSS provides an indication of the performance of the clarification process, and is a measure of the suspended solids in the effluent stream.

As previously mentioned, the WPAF experienced a single TSS permit exceedance on April 27, 2010. However, for the majority of the period from April 2009 through April 2011, TSS levels were well below Permit, as shown in Figure 3-2. TSS monthly average was 8.7 mg/l in April 2009 - March 2010 and 9.8 mg/l during the period of April 2010 - March 2011. Seasonal peaks for TSS during both periods are visible in Figure 3-2 and generally coincide with increased plant influent flows. TSS levels were also below the Agreement limit during the period of April 2009 through April 2011. Permit and Agreement limits are summarized below.

Permit limits: *30 mg/l monthly average; 50 mg/l daily maximum*

Agreement limits: *25 mg/l maximum monthly concentration; 20 mg/l average annual concentration based on a 12 month moving average.*

Figure 3-2: BOD and TSS Compliance[1]



[1]BOD, TSS from OMI Monthly Operating Reports, April 2009 – April 2011.

Fecal Coliform Count: The fecal coliform count is the number of coliform bacteria colonies found in the WPAF's effluent and is directly related to the effectiveness of the effluent disinfection system.

During the period of April 2009 – April 2011, the WPAF received no Permit exceedances for fecal coliform count. Permit and Agreement limits are summarized below.

Permit limits: *200 MPN/100 ml monthly geometric mean; 400 MPN/100 ml 7 day geometric mean; No sample may contain more than 2,400 /100ml (TNTC)*

Agreement limits: *200 MPN/100 ml monthly average; 200 MPN/100 ml maximum month and 150 MPN/100 ml annual average. (Note: average for coliform parameter is presumed to be geometric mean.)*

3.1.1.3. Chlorine Residual

Total chlorine residual is the chlorine concentration present in the plant effluent after the chlorine demand has been satisfied. High chlorine residuals can be toxic to aquatic life, while low chlorine residuals may indicate insufficient effluent disinfection.

During the period of April 2009 - April 2011, the WPAF experienced 6 Permit exceedances for chlorine residual. Permit and Agreement limits are summarized below.

Permit limits: *0.2 – 1.5 mg/l required range obtained through instantaneous monitoring*

Agreement limits: *Same*

Table 3-2 summarizes OMI's Permit exceedances for high and low chlorine residuals during the period of April 2009 through April 2011. In all instances but the January 12, 2010 incident, new effluent grab samples were obtained within 2 hours or less of the original sample and shown to comply with the permit limits when tested. The January 12, 2010 incident occurred when the feed pump speed fell below its lower limit due to low chlorine demand. In response, OMI adjusted the pump programming logic to prevent future occurrences.

Table 3-2:
Exceedances for Chlorine Residual[1]

Date	Exceedance Value (mg/l)	Permit Limits (High/Low in mg/l)
9/15/2009	0.1	1.5/0.2
1/12/2010	0.1	1.5/0.2
4/13/2010	0.1	1.5/0.2
4/29/2010	0.1	1.5/0.2
10/1/2010	0.0	1.5/0.2
3/7/2011	1.8	1.5/0.2

[1] Exceedances from OMI Monthly Operating Reports, April 2009 – April 2011.

3.1.1.4. Total Nitrogen

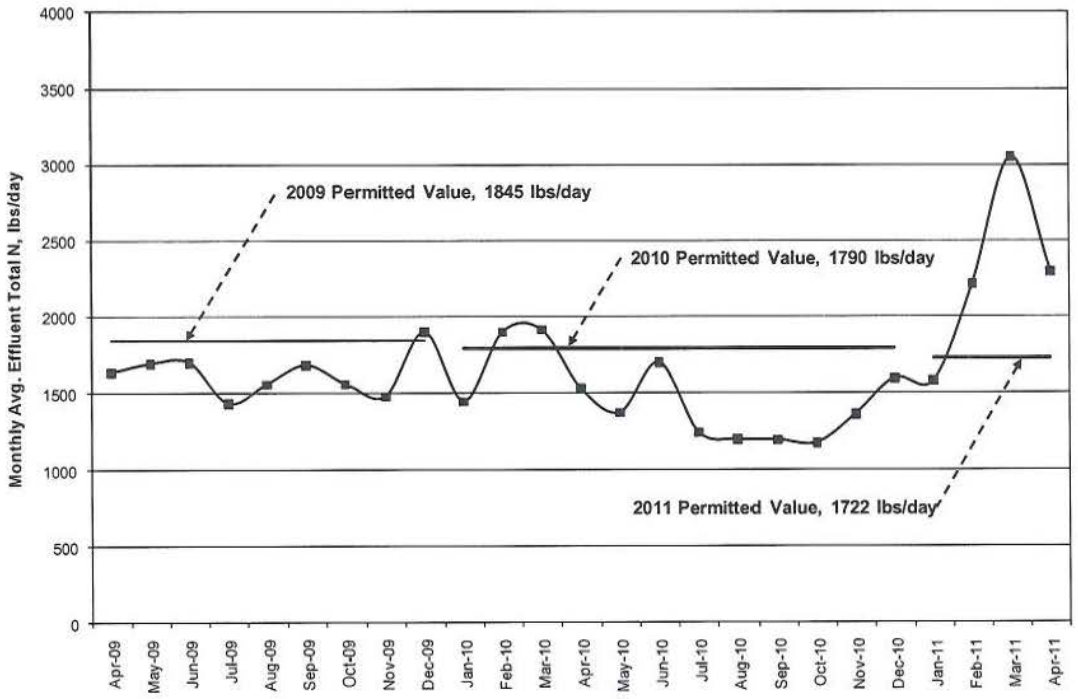
The WPAF's NPDES permit does not have nitrogen limits; however, the State's General Permit for Nitrogen Discharges, re-issued in December 2005, contains Total Nitrogen (TN) permit limits for 2006 to 2010. The General Permit established New Haven's WPAF 2009 TN limit at 1845 lbs/day and 2010 TN limit at 1790 lbs/day on a monthly average basis. The State's General Permit for Nitrogen Discharges, re-issued in December 2010, contains permit limits for 2011 to 2015. The General Permit established New Haven's 2011 nitrogen limit at 1722 lbs/day.

- In 2009, the permit limit for TN was 1845 lbs/day. During the period of April 2009 - December 2009, the permit limit was exceeded in December at a level of 1896 lbs/day. During the same period, the WPAF's monthly average effluent TN was 1623 lbs/day.

- In 2010, the permit limit for TN was 1790 lbs/day. During the period of January 2010 - December 2010, the permit limit was exceeded in February and March at levels of 1895 lbs/day and 1909 lbs/day respectively. During the same period, the WPAF's monthly average effluent TN was 1467 lbs/day.
- In 2011, the permit limit for TN was 1722 lbs/day. During the period of January 2011 - April 2011, the permit limit was exceeded in February and March at levels of 2213 lbs/day and 3051 lbs/day respectively. During the same period, the WPAF's monthly average effluent TN was 2280 lbs/day.

The WPAF's monthly average effluent TN from April 2009 to April 2011 is shown in Figure 3-3. Overall compliance with TN requirements was very good, except in February and March of 2011. OMI reported that these spikes in effluent TN occurred during high flow conditions during an extreme winter. Under those conditions the nitrogen removal efficiency of the WPAF activated sludge/BNR process was severely reduced. It is worth noting that OMI's 2010 monthly average effluent TN (1467 lbs/day) was less than the future TN limit set for 2014 and 2015 (1568 lbs/day).

Figure 3-3: Monthly Average Effluent Total Nitrogen[1]



[1]Effluent TN from OMI Monthly Operating Reports, April 2009 – April 2011.

3.2. Odor Complaints

OMI received only 4 odor complaints as indicated in its Monthly Summary Reports during the period of April 2009 - April 2011. Odor is a priority operation consideration given the Best Neighbor Policy maintained by the GNHWPCA Board of Commissioners.

OMI received 2 odor complaints associated with the WPAF, 1 from an East Haven neighborhood, and 1 from the vicinity of the Boulevard Pump Station. Two of the WPAF complaints were received on consecutive days in February 2011, and were determined to originate from the same source (the sludge holding tanks). Table 3-3 provides a brief summary of the odor control complaints.

Table 3-3:
Odor Complaints[1]

Date	Type	Source
9/2009	Strong	Undetermined
6/24/2010	Faint	Boulevard Pumping Station
2/21/2011	Strong	Holding Tank
2/22/2011	Strong	Holding Tank

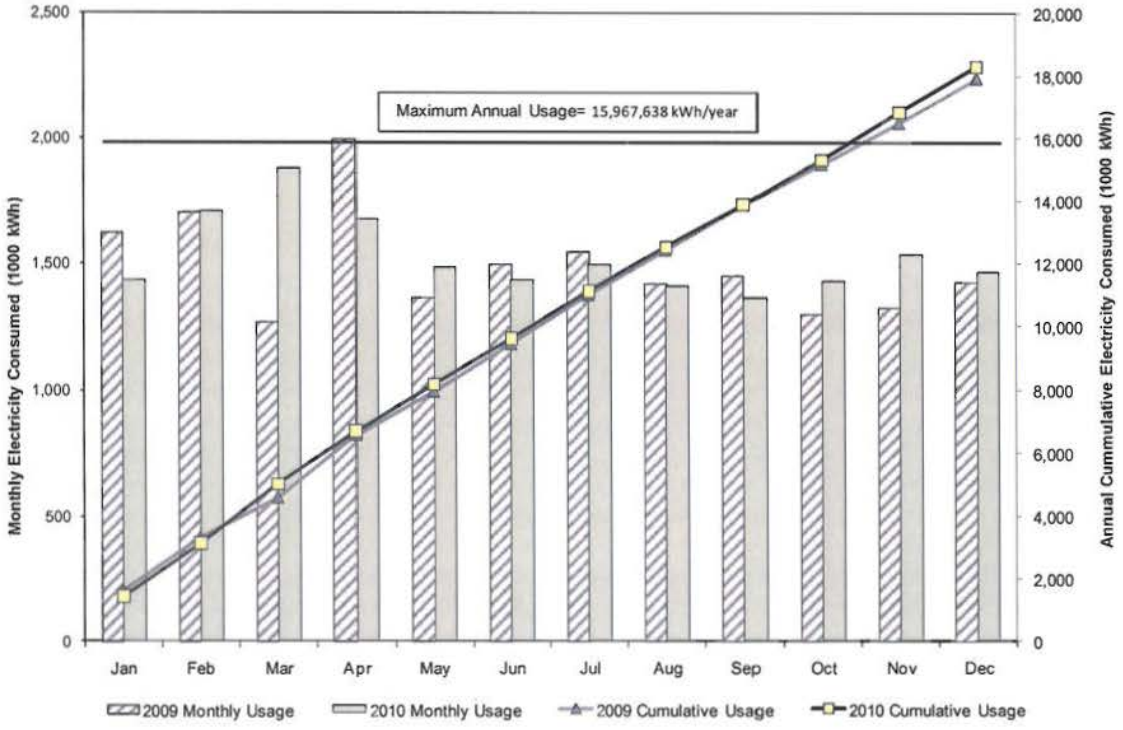
[1]Odor Complaints from OMI Sept 2009 Monthly Summary Report and June 2010 and Feb 2011 Odor Complaint Forms.

3.3. Electrical Power Consumption

In accordance with Schedule 9 of the Agreement, electricity is a pass-through cost to the GNHWPCA up to a maximum annual kilowatt hour (kWh) use, with OMI responsible for paying the electrical costs that exceed this value. The Maximum Annual Usage, adjusted in 2003 for electricity use associated with nitrification inhibition in the BNR process, is 15,967,638 kWh/year.

Figure 3-4 indicates the total electrical consumption for the system for January 2009 - December 2010. Monthly consumption values are from the 2009 and 2010 Electricity Excess Usage Invoices issued to OMI by GNHWPCA (Yr. 2011 data was not yet available). OMI exceeded the adjusted total maximum electrical usage in 2009 by 1,950,158 kWh and in 2010 by 2,342,464 kWh.

Figure 3-4: Monthly and Cumulative Annual Electric Consumption[1]



[1]Monthly electric consumption from Electricity Excess Usage Invoices, Jan 2009 - Dec 2010.

3.4. Chemical Consumption

At the WPAF, chemicals are used in the disinfection process (sodium hypochlorite) and the odor control systems (sodium hypochlorite and sodium hydroxide).

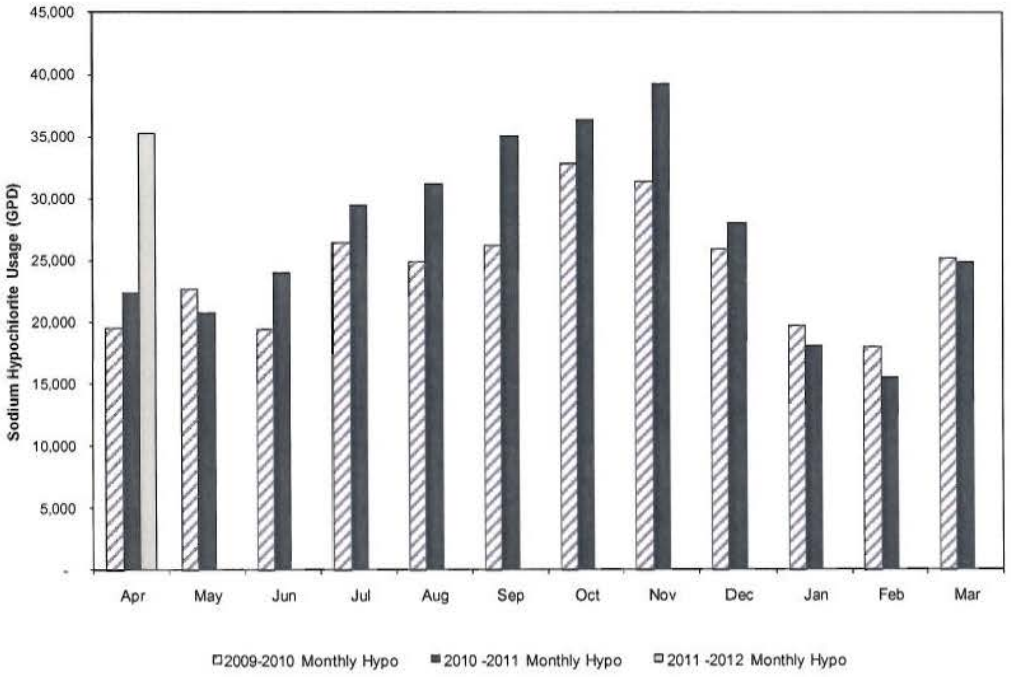
3.4.1. Sodium Hypochlorite

Figure 3-5 below compares reported quantities of sodium hypochlorite consumed annually from April 2009 through April 2011. Sodium hypochlorite is used primarily at three separate locations within the plant; the chlorine contact tanks for disinfection purposes, the AMBI scrubber odor control system, and the inlet works RJ scrubber odor control system.

As shown in the figure, the monthly consumption of sodium hypochlorite in 2010 was generally greater than the consumption in 2009. So far in 2011, sodium hypochlorite consumption is slightly less than consumption in 2010, with the exception of April 2011 which was much greater than the same month in 2010 and 2009. The high usage in April 2011 was likely due to high flows experienced during this period when compared to April

2009 and April 2010. The increase observed in the late summer and early fall months reflects increased chemical consumption by the inlet works RJ scrubber that is double or triple the amount consumed in other months. The sodium hypochlorite usage for disinfection is generally consistent throughout the year.

Figure 3-5: Monthly Sodium Hypochlorite (Hypo) Consumption[1]



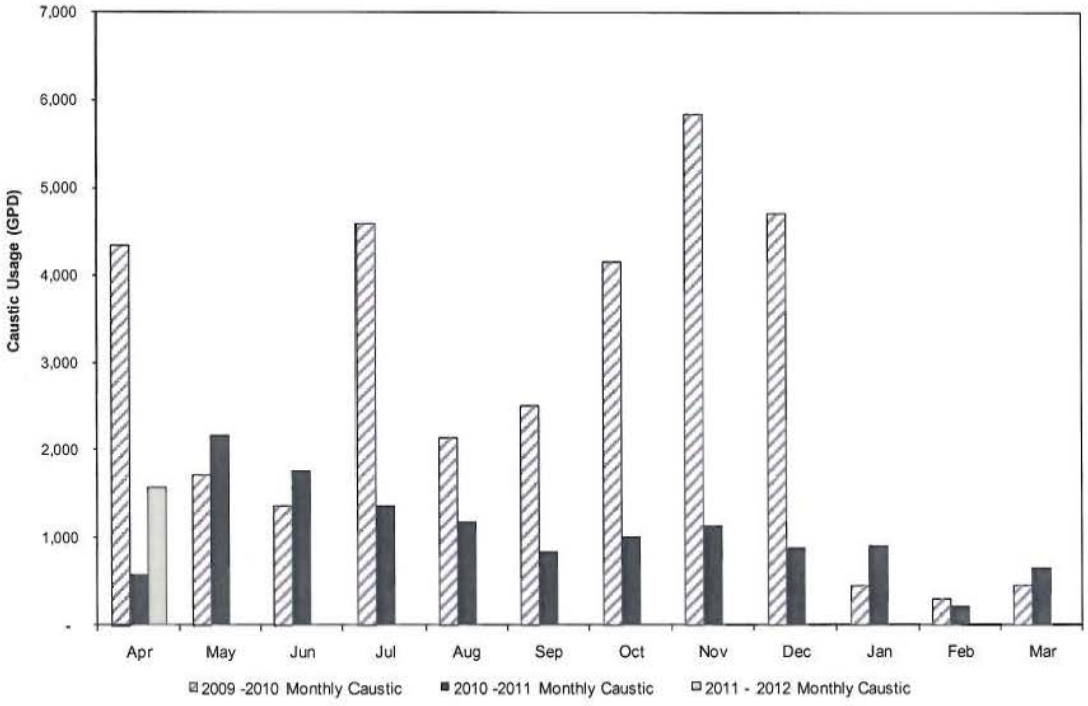
[1]Monthly sodium hypochlorite usage from OMI Monthly Operating Reports, April 2009 - April 2011.

3.4.1.1. Sodium Hydroxide

Figure 3-6 below, compares reported quantities of sodium hydroxide (caustic) used during April 2009 - April 2011. Caustic is used to adjust pH primarily at two locations within the plant; the AMBI scrubber odor control system and the inlet works RJ scrubber odor control system.

As shown in the figure, the monthly consumption of caustic in 2009 was generally much higher than consumption in 2010. So far in 2011, caustic usage is trending relatively close to the amount used in 2010. According to OMI, the decreased use of caustic can be attributed to a greater reliance on sodium hypochlorite rather than caustic for wet scrubber odor control systems. OMI has determined that it is cost effective to use more sodium hypochlorite to reduce the amount of caustic required.

Figure 3-6: Monthly Sodium Hydroxide (Caustic) Consumption[1]



[1]Monthly caustic usage from OMI Monthly Operating Report, April 2009 - April 2011.

3.5. Sludge Production

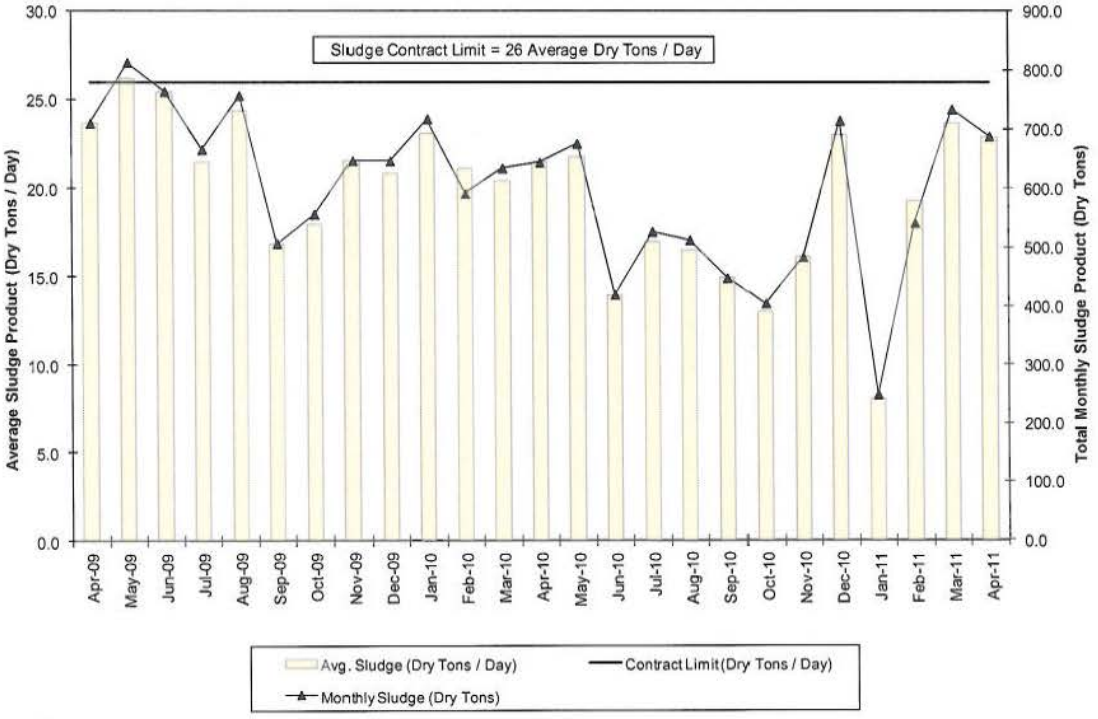
Thickened primary and waste activated sludge (WAS) generated at the WPAF is delivered to the GNHWPCA's on-site sewage sludge incinerator for processing by Synagro pursuant to an operating agreement between the GNHWPCA and Synagro. OMI operates the gravity belt thickeners, which increase the WAS solids concentration. Primary sludge is sent to the gravity thickeners, with thickener underflow passing to a sludge holding tank where it is mixed with thickened WAS and municipal wastewater sludge brought from other facilities. Synagro then takes this mixed sludge, dewaters it and incinerates it in accordance to their Agreement with the GNHWPCA.

The agreement between Synagro and the GNHWPCA allows for the processing and disposal of up to 26 dry tons/day of sludge produced by the GNHWPCA, calculated on a monthly basis. OMI exceeded its monthly allowance only once between April 2009 and April 2011 (26.2 average dry tons / day in May 2009). During April 2009 to March 2010, dry tons of sludge produced totaled 8,016 tons (22.0 tons/day), compared to 6,359 tons produced during April 2010 to March 2011 (17.4 tons/day). The variability seen in OMI's monthly sludge production should be minimized to the extent possible to prevent

the GNHWPCA from exceeding its monthly sludge production allowance under the agreement with Synagro and incurring additional costs for sludge disposal.

Figure 3-7 indicates the dry sludge produced per month at the WPAF during the period of April 2009 through April 2011. These values were obtained from the OMI Monthly Solids Report for the East Shore WPAF.

Figure 3-7: Monthly Sludge Production[1]



[1]Dry sludge produced from OMI Monthly Solids Reports for the WPAF, April 2009 – April 2011.

4. Conclusion

This Contract Operations Monitoring evaluation took place in the second quarter of 2011, during OMI's thirteenth year (Contract Year 13) of operating the System. Pirnie evaluated OMI's overall compliance with the Agreement and acceptable industry standards by analyzing WPAF environmental compliance and performance data, and by observing the operating and maintenance condition of System components during on-site field inspections. Based on our evaluation we offer the following conclusions:

- **The WPAF performed well overall**

  Pirnie evaluated OMI's environmental compliance and adherence to other performance criteria set forth in the Agreement. Performance data was provided for a 2 year period, from April 2009 – 2011.

  During this period the WPAF performed well in terms of the performance parameters set forth by both the Agreement limits and most importantly the NPDES Permit limits for BOD and TSS, fecal coliform, and chlorine residual. In the 2 year period, the WPAF experienced 1 BOD permit exceedance and 1 TSS permit exceedance, which occurred on the same day. OMI's review of the circumstances indicated that a moderate rain event overloaded the secondary clarifiers, resulting in some solids loss that contributed to the excursions. During this same 2 year period, the WPAF experienced 6 Permit exceedances for chlorine residual. In all instances, new effluent grab samples obtained within 2 hours or less of the original sample were shown to comply with the permit limits when tested. OMI had zero fecal coliform permit exceedances. And, with exception of the aforementioned permit exceedances, all Agreement limits (which are more stringent) were achieved.

  The WPAF's overall compliance with Total Nitrogen requirements set forth by the State's General Permit for Nitrogen Discharges was also good, with April - December 2009 and January – December 2010 monthly averages well below the permit limits. During the 2 year period, there were a total of 6 Total Nitrogen exceedances. Total nitrogen spiked significantly in February, March, and April of 2011 during an extreme winter when the WPAF experienced high flow conditions. OMI explained that under those conditions the nitrogen removal efficiency of the WPAF was reduced severely.

- **Process areas and pump stations that received renovations over the past 10 years are in good operating condition.**

  Several of the WPAF process areas (e.g., the Main Sewage Pumps, Aeration Blowers, and Disinfection Chemical System) and medium and small-sized pump stations have been rehabilitated or replaced within the last 10 years. These systems, along with the

newly constructed Truman Wet Weather Storage Tank Facility are in good operating condition and should require only preventive measures to maintain long-term operability of the systems. In addition, both the WPAF and most pump stations have benefited from an overall system-wide SCADA implementation. The improvements allow OMI staff to remotely monitor the stations and receive alarm notifications.

- **Many WPAF and pump station components present significant risk to operations due to being out of service or in poor condition.**

  For the areas that received high risk ratings at the WPAF, namely Grit and Screening, Primary Clarifiers, and Solids Handling, the number of out of service equipment or equipment in poor condition is unacceptable. The same reason applied to the larger stations that received high risk ratings: Boulevard Pump Station, East Street Pump Station, and the James Street Siphon. These systems and stations are not being maintained in accordance with the Agreement or accepted industry practices and standards. In many cases, these systems or stations were operating with little to no redundancy, as with the 4 grit tank/grit collectors that had only 1 operable unit. Or, some major components had experienced prolonged and /or frequent downtime, as with the primary clarifiers. Primary Clarifier No. 3 has been out of service for years, and the entire process lacks scum and skimmings removal because the skimmings tubes are out of service and have been for an extended period of time. These conditions pose an unacceptable risk to the GNHWPCA and require OMI's attention. Within our report we recognize that several components are past their useful lives and are in need of capital investment, or components are part of planned upgrade projects. However, OMI is still obligated per the Agreement to maintain those components until such replacements or upgrades take place.

  In addition, most areas throughout the WPAF and pump stations showed a general lack of attention to housekeeping and routine maintenance, such as standing water, debris, and pipes and equipment in need of painting. Housekeeping and routine maintenance practices should be improved to help maintain the integrity of the equipment and surrounding areas.

  With regards to the CMMS, OMI is in the process of transferring all maintenance data from the existing and obsolete MP2 system to a new "out-of-the-box" solution called Maintenance Connection. OMI should address the outstanding needs identified during our review, and continue negotiations with GNHWPCA to hire a Maintenance Clerk for data entry and upkeep. System implementation and data entry has been slow. The software is capable of satisfying the contract requirements, and if implemented as intended will be an effective tool to schedule and track the required preventive and corrective maintenance.

- **The lack of large diameter sewer cleaning does not comply with the Agreement.**

We recognize that cleaning large diameter interceptors involves complications and considerations beyond those required of typical sewer lines. However, for the duration of its contract with GNHWPCA, OMI has yet to establish a cleaning program or clean any of the large diameter interceptors. These interceptors are not being maintained in accordance with Schedule 2 of the Agreement or accepted industry practices and standards. OMI is obligated per the Agreement to address this issue, either by including those sewers in the three year maintenance rotation, or by proposing an alternative cleaning program to the GNHWPCA for approval.